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AWARD OF THE ALBERT MEDAL FOR 1959

[*Keystone Press*

With the approval of His Royal Highness the President, the Albert Medal for 1959 has been awarded to the Rt. Honble. Vincent Massey, C.H., Governor-General of Canada, 'for his distinguished encouragement of the arts and sciences'.

Mr. Massey had a varied and distinguished career in the fields of education and diplomacy before he succeeded Lord Alexander as Governor-General in 1952, becoming the first Canadian to hold that office. He was born in 1887 and educated at the Universities of Toronto and Oxford, returning to the former in 1913 as lecturer in Modern History. During the First World War he served

as Associate Secretary of the War Committee of the Canadian Cabinet and subsequently became Director of the Government's Repatriation Committee. He was appointed Minister without Portfolio in the Dominion Cabinet in 1925, and in the following year went to Washington as Canadian Minister.

Mr. Massey became well known in this country during his long residence as Canadian High Commissioner in London from 1935–46. Though the exigencies of the times made his official duties particularly arduous and responsible, he showed a characteristically active concern for the welfare of the arts as a Trustee of both the National Gallery, London, and the Tate Gallery during these years.

After his return to Canada, Mr. Massey was selected for a task of great national importance. In 1949 during his term of office as Chancellor of the University of Toronto, he became Chairman of the Royal Commission appointed to survey the development of the Arts, Letters and Sciences in Canada. The report which he and his colleagues on the Commission presented at the end of their two-year review is an educational document of great value, and one bearing the impress of his own concern with the ordinary citizen's needs and desires. A direct outcome of the recommendations of the Massey Committee (as it came to be known) was the establishment, in 1957, of the Canada Council for the Promotion of the Arts, Letters and Humanities. In its first two years of work this foundation has set a pattern of creative patronage for the arts which has been described as 'of inestimable benefit to the whole Canadian community'.

Mr. Massey is Honorary Chairman of the National Gallery of Canada, and has been the recipient of honorary degrees from many universities in the Commonwealth.

FINAL MEETINGS OF THE SESSION

WEDNESDAY, 27TH MAY, at 2.30 p.m. '*The Development of the Port of London*', by Sir Leslie Ford, O.B.E., General Manager, Port of London Authority. John Hay, M.P., Parliamentary Secretary, Ministry of Transport and Civil Aviation, will preside. (The paper will be illustrated by a film.)

WEDNESDAY, 3RD JUNE, at 2.30 p.m. '*The Contribution of Psychiatry to Modern Medicine*', by D. Stafford-Clark, M.D., F.R.C.P., D.P.M. Sir Selwyn Selwyn-Clarke, K.B.E., C.M.G., M.C., M.D., F.R.C.P., M.R.C.S., a Member of Council of the Society, will preside.

ANNUAL GENERAL MEETING—PRELIMINARY NOTICE

The 205th Annual General Meeting of the Society, for the purpose of receiving the Council's report and the Financial Statements for 1957, for the amendment of the Bye-laws and for the election of officers, will be held at the Society's House at 3 p.m. on Wednesday, 1st July, 1959.

PROGRAMME FOR THE 206TH SESSION

The Council will shortly be considering the Programme of Meetings for the forthcoming Session. Fellows are invited to forward suggestions for lectures and papers to the Secretary by 19th June, 1959.

THE SOCIETY'S CHRISTMAS CARD FOR 1959

The Society's Christmas Card for 1959 will show a picture, especially painted by Miss Anna Zinkeisen, R.O.I., R.D.I., of T. R. Crampton (1816–88), the engineer, and his railway engine, the 'Namur', in a lively winter scene. For the invention of this narrow-gauge locomotive engine, which he designed for the Liège and Namur railway, Crampton was awarded the Society's gold medal in 1846.

A reproduction of Miss Zinkeisen's painting and an order form for the card will be included in the *Journal* at a later date. The more distant overseas Fellows of the Society, however, may wish to anticipate the form and save time by placing an order in writing now. If the name and address are required to be overprinted, the exact wording should be given.

INDUSTRIAL ART BURSARIES EXHIBITION

The Exhibition of winning and commended designs submitted in the 1958 Industrial Art Bursaries Competition was opened in the Exhibition Rooms of the Society's extension premises by Sir Harry Pilkington, Chairman, Pilkington Brothers Ltd., on Monday, 27th April.

In a short speech of welcome to Sir Harry, Sir Ernest Goodale, C.B.E., M.C., Chairman of the Industrial Art Bursaries Board, said:

> As the Chairman of the Bursaries Board of the Royal Society of Arts it is my great pleasure this afternoon to introduce to you Sir Harry Pilkington. Many of you here know Sir Harry; he is a Past-President of the Federation of British Industries, and he is extremely flexible in spite of the fact that I think he is almost compounded of glass—if he is not, he really ought to be from the life he has led in the glass industry! He takes great interest in any matter that advances the cause of British industry, whether it is at home or overseas, and we are very glad to have him here to-day to see something of the work in various branches of industrial design of these students from the leading art schools of the country.

SIR HARRY PILKINGTON *then spoke as follows:*

> I am very glad to be here to-day to open this Exhibition. I am, I believe, the first industrialist who has been invited to this annual affair to open it; I am a strange choice because I do not come from one of the industries that is peculiarly suitable for the type of design that is taught at Colleges of Art. We are, in my industry, tremendously dependent on good design of machinery and of plant, and we are dependent for the use of our product on the design of buildings and motor cars and furniture so that they may use a lot of glass in economical and æsthetic ways. But that is not design in the sense in which

it is used here, and those are not the kinds of designs that the students of Colleges of Art have been asked or encouraged to go in for in competing here. But no one who has been overseas as much as I have (though I have not been nearly so much as Sir Ernest), or is in contact with any export market, can fail to be aware of the importance of design in the consumer goods industries in developing our trade at home and abroad.

We are living in an increasingly competitive world, much more competitive than in the years immediately after the war when these bursaries were first started, and I pay tribute to the far-sightedness of those who originated this scheme and put design on the spot at a time when we were living in an age of austerity, when almost anything would do (to 'Make Do and Mend' was, after all, the slogan), and when it was easy enough to sell goods on delivery and price, with little regard to quality and none to design.

I have been interested to see that several of the candidates to-day are here for the second time, and sometimes trying quite new lines. I hope—though I don't know—that some of those who won bursaries ten or twelve years ago have now achieved prominent positions as designers in industry, and that the designs which they have produced in their particular lines have helped their employers and their industries to reach out into the markets of the world and bring back valuable orders for this country. In most such cases I should imagine that the designs which they have produced and which are now being used are nothing like those they produced when they were students, but I hope that they learned enough from the £150 worth of travel overseas to improve their knowledge of what was required. In many cases the designs could not be identical because so many of these consumer goods are of a kind where designs are necessarily purely ephemeral—what is fashionable to-day is gone to-morrow, or at any rate by next year. What is wanted in those trades is something immediately profitable rather than lasting, something that will divert to one particular manufacturer or one particular design a larger share of the trade of the moment; and quickness in imagination and determination to get there first is what is most useful in that case. In that kind of trade the designer's job, although still related to first principles, is constantly to be thinking of new designs; it is an interesting, attractive occupation, a bit chancy, but not to be taken lightly or casually; in such cases maybe, as in *The Times* crossword puzzle, one can quickly detect the hand of the same designer producing another one in a family of designs, all with a similar motif, or basic concept, changing only in the light of changing tastes—changes whose precise direction is so difficult to foretell, but I suppose it is the job of the designer not merely to foretell it but to influence it.

But personally I still attach the greatest importance to the designer who does not expect to design a series of successful but short-lived designs, but something of lasting value, and in particular something really fitted to modern methods of production, that eliminates waste and that is suitable for a mass production world where standardization and simplification do make for more economical methods of manufacture, of stocking, and of distribution. In many an industry, including my own, where we do have designs, as a rule we want them to be lasting. When I joined my firm, the most popular of the many Figured Rolled patterns of glass, as we call them, used in very large quantities, were Muranese, Arctic and Flemish glasses. Muranese was an early Victorian pattern—even now we sell quite a lot, but when I came to the firm it was still third or fourth on the list of patterns sold; Arctic was one created in about the early part of this century, Flemish a little bit later—to-day those three are still among the top sellers. In the last thirty years we have employed many people, at a bigger fee than £150 too, to design for us fresh patterns of Figured

Rolled glass. Very seldom indeed have any of these designs caught on, superior though they may obviously appear to the intellectually and æsthetically trained mind. This isn't only because the public knows what it wants (and what it wants is not often what it ought to want), it is partly because in my industry, and I believe in many others, permanence and replacement is of great importance. We all know how the willow pattern design, for one, has been of such lasting value and of such importance in the china trade—we can think of many others, I am sure, in the house, where some designs have lasted for ever and where we have wanted to be able to replace and to repeat them. The production of an outstanding and permanent design, if it is both good and happens to catch on (and these are not always the same things), may be worth hundreds of thousands of pounds of export trade to this country.

And that brings me once more to the question of who are the public for whom you are designing. Not those for whom you would think you would like to design, not in order to fashion other people's minds in the likeness of your own, not to show yourselves as good designers of something fancy, but to design what is wanted—to be perhaps in line with, or a little bit ahead of, the contemporary view of what is good taste; but not to be far out in front, nor behind, nor to one side—in fact, to be in touch.

But I would say more than that. This country lives on its export trade—40 per cent of our manufactures go abroad, a proportion that must rise even higher—but they don't go just to one export market; for most trades there is no such thing as *the* export market. There are many different export markets, and in most industries and most trades there are some markets that are very much more important than others for some consumer goods, and those are changing with the development of domestic manufacture in some countries and more particularly with the growing awareness of the emergent countries in Africa and the East; while for others and for more durable goods, Europe and North America are the fastest-growing importing parts of the world. And even within any one industry, some firms will specialize in dealing with one part of the world and others with other parts elsewhere. Design, more than most things, is a matter that must be related to the consuming public in the market to which the product is intended to go. I see no purpose in designing something that will simply be of use to this country if we really are hoping to sell it abroad, and for that reason I would emphasize that when—as I see is always intended—the winners of these bursaries travel abroad they should try to travel objectively, just as they always try to do their designs objectively for a definite user. (And of course I have been very struck by the objectiveness of the problems set for this bursaries competition.) They should travel not merely to study design centres in some other countries, not to do the Victorian 'Grand Tour of Europe', nor to do the modern equivalent by rushing to Scandinavia because somebody has said that Scandinavia is just now a place of good design, but to think in terms of the export to the market they are aiming to serve, to study on the spot the customers' needs, rather than to try and pick the competitors' brains; to go, if need be, to the Argentine, or to Ghana or to India, or maybe it is to Canada or to Australia or to France, where the particular product is to be sold, and try to see what kind of things are likely to be wanted there, what suits that climate, that quality of light, that tradition, those conditions generally; and design in accordance with that, not in accordance either with what is being used here or what is being designed in some quite different place. We must try to link our own native genius and habits with the need of the market which we are trying to serve and not try and get a hybrid based on something quite different.

There is one other thing that I should like to say on this. What is it that, on the whole, we in England should be best placed for manufacturing, the type of

market for which we should design? I don't believe that we should aim particularly at satisfying the mass-production, low-price market. I think for many mass-produced things Hong Kong and the Far East are going to be far better places to produce the cheapest kinds, based on the lowest cost of labour. I don't believe that in consumer goods we have any hope of competing with the very low wage countries in terms of sheer cost; I don't believe that we can win solely on price. Value for money we must offer, but more value for more money. I am quite sure that the increase in the standard of living means an increase in spending on personal comfort as well as on saving, and that most people are prepared to spend a bit more money each year, providing they can get what they want. This means that the mass production consumer market is moving up a bit in quality every year—a phenomenon first pointed out in the changing habits of buying food, and I would also say in the habit of purchasing clothing and a good many household furnishings and requisites as well—and that is something we should take advantage of.

Equally I do not think that we ought to aim just at a very Ritzy or Steuben Glass type of market and go back to something that is not mass production, because this is a mass production world. In the last few years there have been most worthy, but if I may say so, most spinsterly, attempts to revive handicrafts and put the clock back and to face our future with our backs to it, as it were, instead of looking it in the face. So I conclude that in matters of design we should constantly set our sights on mass production of increasing amenity value and of permanence, and aim always at a slightly higher market and at always being a little bit out in front—not too far—on questions of taste.

I have forborne to say what most people have said when opening this Exhibition—that is, the importance when entering a competition with rules of abiding by the rules—but if you want to know the importance of that, read the speeches of the last three speakers on this occasion. I would say that there has been an improvement in this respect this year, and I am very glad to see such an interesting collection of designs. I have pleasure in declaring this Exhibition open.

SIR ALFRED BOSSOM, BT., LL.D., F.R.I.B.A., J.P., M.P., *Chairman of Council of the Society, then said:*

I once heard one of our most eminent personalities say at an exhibition of the work of younger people, 'You know, it is you young designers who are going to open the doors to the future for our country'. Now, to the winners of the Industrial Art Bursaries: you have got the opportunity, going abroad and seeing what other people are doing, and then coming back and, as Sir Harry has said, taking us a little bit ahead of the general market—not a great distance, not so that the articles you design would seem too incongrous to those who we desire should buy them. It is, of course, impossible, to expect either our home or foreign customers to change all their existing possessions to make room for ours. So do try in your work to recognize that some sense of harmony must be considered in a great many instances.

Sir Ernest Goodale has been more responsible for inspiring and pushing ahead with these Bursary Competitions than anybody, and I am sure that not only the Royal Society of Arts and the bursary students but the entire community in England owe a real debt to him for all he has done in this special direction.

We greatly appreciate the visit of Sir Harry Pilkington to open this show for us to-day, and we thank him exceedingly for the sound common sense in the talk he has given to the students here, and we hope he will come again another year when we shall have some other and equally fine things to show him.

Indeed I thank you, Sir Harry, for all your advice and encouragement.

A vote of thanks to Sir Harry Pilkington was passed with acclamation, and the formal proceedings then ended.

The Exhibition was on view in the Society's new rooms until 20th May. Arrangements are being made for it to be shown later this year in Belfast, Birmingham, Edinburgh, Newcastle-upon-Tyne, Stoke-on-Trent and, possibly, Falmouth. Precise dates will be announced in the *Journal*.

MEETING OF COUNCIL

A meeting of Council was held on Monday, 11th May. Present: Sir Alfred Bossom (in the Chair); Mrs. Mary Adams; Dr. W. Greenhouse Allt; Sir Hilary Blood; the Honble. G. C. H. Chubb; Sir Edward Crowe; Mr. R. E. Dangerfield; Sir George Edwards; Mr. Peter Le Neve Foster; Mr. John Gloag; Sir Ernest Goodale; Mr. A. C. Hartley; Dr. R. W. Holland; Lord Latham; Mr. Edgar E. Lawley; Mr. Oswald P. Milne; Lord Nathan; Mr. Paul Reilly; Sir Gilbert Rennie; Mr. A. R. N. Roberts; Sir Selwyn Selwyn-Clarke; Sir Philip Southwell; Professor S. Tolansky; Mr. G. E. Tonge; Mr. Hugh A. Warren and Miss Anna Zinkeisen; with Dr. K. W. Luckhurst (Secretary); Mr. G. E. Mercer (Deputy Secretary) and Mr. J. S. Skidmore (Assistant Secretary).

ELECTIONS

The following candidates were duly elected Fellows of the Society:

Ades, Harold, New York City, New York, U.S.A.
Alton, The Reverend Kenneth, Bedale, Yorks.
Baker, Walter Roy, Leeds.
Barclay, Robert Louis, A.R.I.B.A., Brisbane, Queensland, Australia.
Bartholomew, Stanley Nicholas, Woodford Green, Essex.
Bews, Donald Cameron, M.D., C.M., D.P.H., Senneville, P.Q., Canada.
Birns, Alexander, Nelson Hall, Stafford.
Campbell, Archibald Donald, M.D., C.M., Westmount, P.Q., Canada.
Clarke, John Ernest, Downham Market, Norfolk.
Colley, Eric Dalston, A.R.I.B.A., Preston, Lancs.
Cowell, Ronald Josiah, Royston, Herts.
Cox, Mrs. Irene Norah, Worthing, Sussex.
Crocker, Leslie Edwin, Huddersfield.
Dalby, Thomas, London.
Dawson, Douglas Lionel, A.T.D., Leeds.
Dawson, Mrs. Gillian Gordon, Leeds.
Dewar, Mrs. Nan Balfour, London.
Evans, Frank, B.Sc., London.
Ferguson, Malcolm Hewit, Windermere, Westmorland.
Fitton, Joseph, M.Sc., A.T.I., Rochdale, Lancs.
Freedman, Alfred, London.
Friedmann, Helmut, London.
Goh, Mrs. Edith Yan Chum, London.
Hewertson, Thomas Scambler, Wallington, Surrey.
Hopps, Air Vice-Marshal Frank Linden, C.B., C.B.E., A.F.C., London.
Hudson, Mrs. Elizabeth Constance, Sidcup, Kent.
Hume, Miss Lois Mary, London.
Ikejiani, Nathan Chukuemeka, London.

Jones, Miss Pamela Lucy Ray, Derby.
Joyce, Mrs. Joan Marguerite, London.
Lallemand, Jean C., B.A., Montreal, P.Q., Canada.
Lohse, Mrs. Jeannette Stephens, Toronto, Ontario, Canada.
Lodge, Frederick Reginald Harold, Uxbridge, Middx.
Low, Miss Mildred Rhoda, London.
Meldrum, Miss Lillias Anderson, Motherwell, Scotland.
Meredith, Hubert Angelo, O.B.E., London.
Momoh, Kessington Salmanu Yerima, Auchi, Benin Province, Western Nigeria.
Parker, Mrs. Evelyn Kathleen, Enfield, Middx.
Robson, Lawrence William, F.C.A., F.C.W.A., Woodstock, Oxon.
Scott, Professor Kenneth John, M.A., LL.B., D.P.A., Wellington, New Zealand.
Sutton, George, A.M.C.T., A.M.I.Mech.E., London.
Rose, Malcolm Brian, Norwich.
Saxton, Philip R., Chesterfield, Derby.
Tibbitts, Leonard St. John, B.Sc.(Tech.), A.T.I., Felsted, Essex.
White, James Trevor, M.S.I.A., London.
Woodhead, Derek Conrad, Pudsey, Yorks.
Wright, Mrs. Lilian Anne, Hove, Sussex.

The following candidates were elected Associate Members of the Society:

Blackburn, David, Huddersfield.
McGann, Michael Philip, London (*Industrial Art Bursary winner in* 1958).
Nevile, Brinsley Thomas Sanford, Hope, British Columbia, Canada.
Taylor, Miss Marian, Rossendale, Lancs.
Wilkins, Keith Matthew, Slough, Bucks (*Industrial Art Bursary winner in* 1958).

CHAIRMAN OF COUNCIL, 1959–60

Mr. Oswald P. Milne, F.R.I.B.A., J.P., was designated to serve as Chairman of Council for the year 1959–60.

BALLOTING LIST

The Balloting List for the new Council was prepared for the Annual General Meeting.

PROPOSED ANNUAL RECEPTION

Agreement was given in principle to a proposal to institute an annual reception for Fellows, the first of which functions will probably be held in the Society's House early in 1960.

'AFFILIATED COMPANIES'

The Council decided to propose to the Society at the forthcoming Annual General Meeting Bye-laws which will make possible the admission of 'Affiliated Companies'.

ARMSTRONG MEMORIAL TRUST

Mr. A. C. Hartley was appointed as the Society's representative (*vice* the late Mr. E. M. Rich) on the Armstrong Memorial Trust.

CHADWICK TRUST

Sir Selwyn Selwyn-Clarke was appointed as the Society's representative (*vice* the late Mr. E. M. Rich) on the Chadwick Trust.

OTHER BUSINESS

A quantity of financial and other business was transacted.

A STUDY OF THE POLLUTION OF THE THAMES ESTUARY

A paper by

B. A. SOUTHGATE, C.B.E., Ph.D., D.Sc.,

Director, Water Pollution Research, D.S.I.R., read

to the Society on Wednesday, 18th March, 1959,

with Herbert W. Cremer, C.B.E., M.Sc., F.R.I.C.,

Chairman, Thames Survey Committee, in the Chair

THE CHAIRMAN: I regard it as a great privilege and pleasure to be asked to take the Chair this afternoon. I have known Dr. Southgate for some twenty years, during which time I have become quite intimately associated with much of the work carried out at the Water Pollution Research Laboratory. Dr. Southgate has a world-wide reputation in his subject, and I think there is no one better qualified to deal with the many complexities of this problem than he. I have had the benefit of reading his address, and of knowing something of the volume of work that has been carried out during the past ten years in connection with the Thames Survey. I imagine that he must have had considerable difficulty in compressing his subject into such a small compass.

Some of you may think that ten years is rather a long time to occupy a survey of this kind, but it should be borne in mind that the tidal waterway concerned stretches from just below Teddington Lock to the open sea beyond the Nore—a very considerable distance; and over that distance the river and its bed exhibit many variations, as do the quantities and the characters of the polluting effluents which are discharged to the river. Many factors have had to be taken into consideration—tidal, seasonal, meteorological, geological, chemical, biological—also new analytical and other techniques have had to be devised, some of which can be applied to other river and estuary problems. It has been a very complex business altogether.

The following paper, which was illustrated with lantern slides, was then read.

THE PAPER

It is now some ten years since the Water Pollution Research Laboratory began to study the Thames Estuary with the aim—which it is now evident was a very ambitious one—of trying to account for the deterioration in the sanitary quality of the tidal water which has occurred during this century, and to predict what measures would be necessary to remove the offensive conditions in the central part of the estuary which had given rise to widespread complaints. We were aware when we began that there was very little accurate information on many of the mechanisms with which we would be concerned, and experience has shown that our lack of knowledge was very much greater than we had thought. We have, however, persisted in the survey because the processes involved in the decomposition of polluting matter in the Thames Estuary are essentially the same as those which occur when any bodies of water, including fresh-water

rivers, are polluted by organic wastes; thus information obtained and techniques developed during the survey can, with suitable modifications, be applied to the study of the effects of pollution generally. It is, we think, important that this kind of study of the effects of pollution should be pursued, particularly at present when River Boards are giving so much thought to the quality of effluents, both domestic and industrial, which they are prepared to accept in the rivers for which they are responsible. In putting forward standards of this kind it is clear that a River Board should know, at least approximately, the effect which an effluent of a specified quality will have on a river below the point of discharge, and it is on this problem of predicting the results of pollution that the work on the Thames has a direct application.

When I was asked some nine months ago to give an account of our work I expected that by now it would have been finished. As has happened so often before, however, we have discovered several points which still require investigation and I am not able therefore to give a final account of the work, though I hope to show that we have made some solid progress in understanding the mechanics of the estuary.

The two largest sources of pollution are the discharges from the Northern and Southern Outfall Works of the London County Council at Barking and Crossness. For many years the sewage reaching these works was treated only by sedimentation, but in 1931 an activated-sludge plant was brought into operation at the Northern Outfall to give biological treatment to about a quarter of the dry-weather flow. No further major changes were made until in 1955 the first stage of a very large programme of extensions at both works was brought into operation by installation of primary sedimentation tanks of modern design at the Northern Outfall Works; this has reduced markedly the concentration of suspended sewage solids passing to the estuary. At the same works the activated-sludge plant is at present being considerably extended and digesters for the treatment of sludge are being built. Work is also in hand to modernize the Southern Outfall Works, where the whole flow of sewage will be treated by the activated-sludge process.

The sewage effluents from London represent the largest two sources of pollution entering the estuary, but there are many other polluting discharges. Although most of the industrial wastes in the area are discharged to domestic sewers there are some separate discharges to the estuary, particularly in its lower reaches. Several local authorities and drainage boards outside the area of the London County Council discharge sewage to the estuary, sometimes after partial treatment and sometimes, as in the case of the West Middlesex Works near the head of the Estuary, after full biological treatment. Several tributaries bring in considerable amounts of polluting matter. The upper Thames itself, as it flows over Teddington Weir, is a comparatively clean river, though at times of high flow it carries considerable amounts of organic matter, much no doubt derived from the agricultural land through which it passes. At the other end of the estuary, the sea will carry in organic material—the quantity from this source is very difficult to assess.

SURVEYS OF THE ESTUARY

Probably more detailed information on the condition of the Thames Estuary is available than for any other waterway in the world. Observations by the Metropolitan Board of Works began in 1880 and these have been continued and greatly extended by the London County Council[1]. The results have been made freely available to the Water Pollution Research Laboratory, and in addition the Laboratory itself carried out detailed surveys between 1951 and 1954, using a launch and a laboratory at Tilbury provided by the Port of London Authority.

When we began work in 1949 the L.C.C. had identified the chief factors which at times caused a nuisance in the central reaches. It was known that the most important consideration was the distribution of oxygen in solution in the water. Since the centre of gravity of the polluting loads discharged is near the middle of the estuary, the form of the curve for distribution of oxygen is U-shaped, the water being nearly saturated near Teddington and Southend but containing little oxygen in the central zone, the minimum value being found usually near the Outfall Works. It was known also that when, but only when, the concentration of oxygen fell to zero, hydrogen sulphide might be produced; it was the foul smell of this gas which had given rise to complaints. Surveys had shown also that nitrate was present in the estuary, sometimes to the extent of several parts per million, but that when the concentration of dissolved oxygen fell to a low level, the nitrate gradually disappeared. Under these conditions

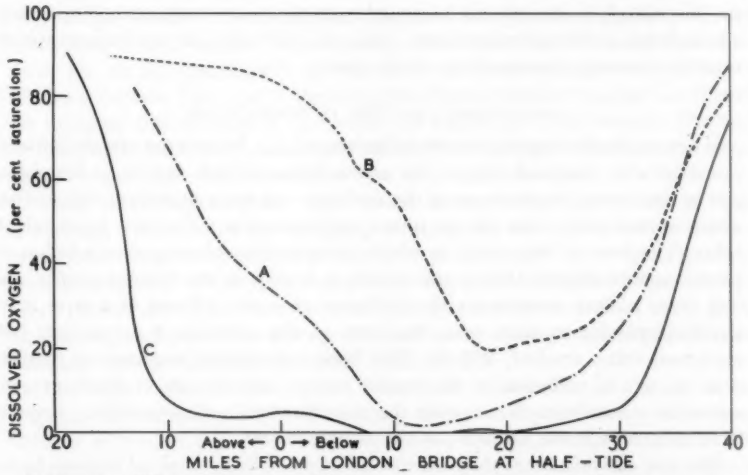


FIGURE 1. *Effect of flow at Teddington on the distribution of dissolved oxygen in the Thames Estuary :*

A. *Jan.–Mar.* 1934. *Flow at Teddington* 497 *m.g.d.; Mean temperature* 6·5°C.
B. *Jan.–Mar.* 1937. „ „ „ 4802 *m.g.d.;* „ „ 7·4°C.
C. *July–Sept.* 1949. „ „ „ 96 *m.g.d.;* „ „ 22·4°C.

nitrate can be reduced by the action of bacteria, the oxygen it contains being made available. Thus the nitrate represented a reserve of oxygen which was used in the oxidation of polluting matter in the central reaches at times when the amount of gaseous oxygen in solution was itself low.

Before 1949 anaerobic conditions, with liberation of sulphide, had occurred during a comparatively short period each year, usually during the dry warm months of July to September. It was known that the distribution of dissolved oxygen was greatly affected by the fresh-water flow at Teddington; this can be seen from Figure 1, where two curves are given, one for the months January to March of 1934, when the flow at Teddington was about 500 m.g.d., and the other for the same period of 1937, when the flow was about 5,000 m.g.d. The average conditions during July to September, 1949, when the temperature was higher and the average fresh-water flow was less than 100 m.g.d., are shown in the third curve of the figure; in this period there was a length of about 7 miles of the estuary in which there was no detectable oxygen in solution and where, no doubt, sulphide was being evolved.

The first step was to examine the voluminous data made available by the L.C.C., to ascertain whether by statistical analysis any more precise relation could be found between the condition of the estuary at any time and the factors which might be thought to affect it. Although the results of the statistical analysis threw a good deal of light on the changes which had occurred in the condition of the estuary[2], it was concluded that it would be quite impossible, by using this method alone, to predict what the effect of future changes in conditions would be. Accordingly an attempt has been made to apply a more basic method involving a knowledge of the various physical, chemical, and biological mechanisms which together determine the condition of the water.

MECHANISMS INVOLVED IN PURIFICATION

When oxidizable organic matter is discharged to a fresh-water stream initially saturated with dissolved oxygen, the concentration of this oxygen at first falls, and at some point downstream of the discharge reaches a minimum value, after which it rises and, if the stream is not again polluted, will return to its initial value. The form of the curve, in which concentration of oxygen in solution is plotted against distance below the outfall, is known as the 'oxygen profile', or 'sag curve'. When considering the discharge of a new effluent to a river it is clearly important to know what the form of this curve, and particularly the minimum value reached, will be. The basic information required to predict it is the rate of oxidation of the organic matter, and the rate at which oxygen enters the stream from the air when the concentration in solution falls as a result of its utilization in the oxidation of the organic matter.

The rate of oxidation of the particular effluent can be determined in some form of respirometer in the laboratory. The rate at which oxygen enters a stream from the air is directly proportional to the oxygen deficit—that is to the difference between the concentration in solution at any time and the concentration at which the water would be saturated and in equilibrium with the atmosphere. The

rate of solution at any particular oxygen deficit, however, is also directly proportional to a factor referred to as the 'exchange coefficient', which depends on the motion of the water and to a lesser extent on the nature and composition of substances dissolved in it, and which can be determined experimentally, though laboriously, for any part of a stream in which conditions are reasonably constant[8]. Predicted sag curves for rivers are in some instances quite close to those observed, but this is usually where the stream is very large and deep, so that conditions remain reasonably uniform over a long distance and the effect of deposition of organic matter on the bottom is comparatively small. In England, where rivers are on the whole shallow, predicted curves are likely to be much more inaccurate, partly because of the greater relative effect of bottom deposits and partly because of greater variability in the exchange coefficient from one reach to the next.

It is, however, an elaboration of this method of approach which we have attempted to apply to the Thames Estuary, since it seemed that no other method could yield the information desired.

Conditions in an estuary are obviously more complex than in a stream flowing in one direction. The movement of the water is oscillatory under tidal action with a seaward flow of fresh water from the upper river and tributaries, and at the seaward end there is an open boundary across which saline water can both enter and leave. In such a system the effects of a polluting effluent occur both downstream and upstream of the point of discharge. There are also likely to be wide variations from place to place and from time to time in the exchange coefficient for oxygen, since the surface of the water may vary from smooth to very rough. Another expected complication is that due to deposition of mud containing organic matter. In an estuary, part of this organic matter may enter from the sea and the amount of this cannot be accurately determined. In the Thames, deposited material in the navigable channel and dock systems is removed by dredging and dumped at sea outside the boundary of the estuary. The flow of fresh water known to be important varies of course widely from time to time; there is also the usual seasonal variation in temperature.

Thus, when beginning the work, it was expected that there would be large day-to-day variations in the conditions affecting the composition of the estuary water and it was assumed that it would be possible only to try to forecast the average condition of the water over a fairly long period. Periods of three months were chosen and it has been assumed (though this will introduce some error) that during each period the average condition of the estuary will be in equilibrium with the average values of the factors which affect it.

The object then was to predict, from basic information, the shape of the oxygen distribution curve in the estuary under widely different natural conditions of fresh-water flow and temperature, and to compare this with the corresponding curve directly observed. It was thought that if the two were in reasonable agreement it would be valid to predict by the same methods the distribution of oxygen expected if changes were made in any of the factors which affect it, particularly in the quantities of polluting matter discharged at different points. The following are some notes on the various stages in these calculations.

DISPERSION IN THE ESTUARY

Methods which have been proposed for calculating the dispersion of liquids discharged to an estuary have usually depended on assumptions regarding the extent to which the water is mixed under tidal action[4], but these methods do not represent at all accurately the dispersion of substances in the Thames.

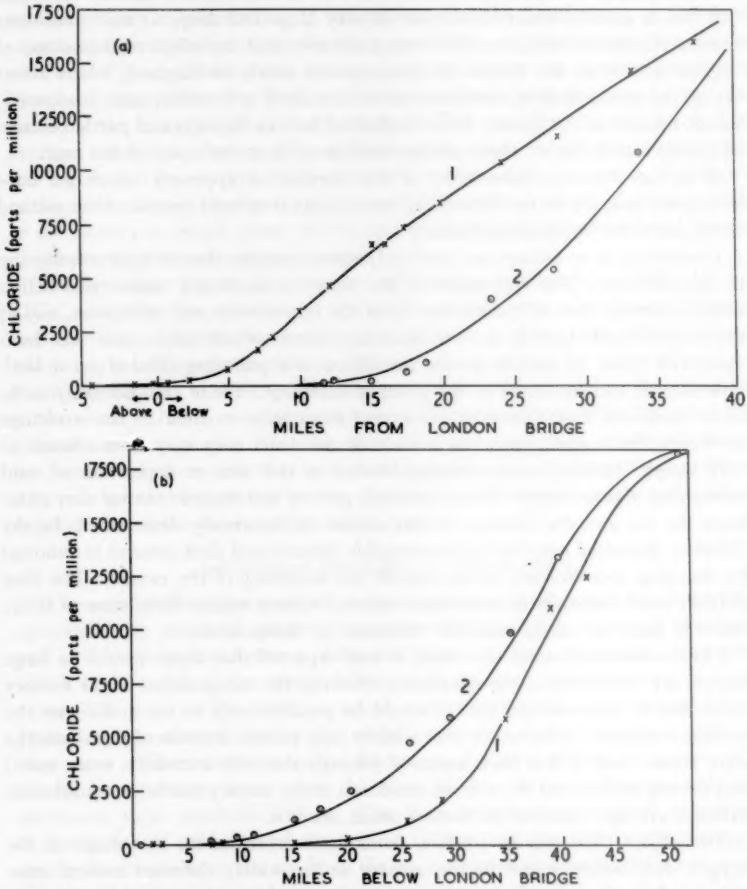


FIGURE 2. *Curves showing the accuracy of calculation of changes in salinity of the Thames Estuary. In each graph Curve* 1 *was fitted to points marked by crosses showing readings on a given date and Curve* 2 *shows the estimated salinity* 14 *days later. The circles indicate the values observed after* 14 *days.*

(*a*) *Flow at Teddington increasing*

(*b*) *Flow at Teddington decreasing*

(From W.S. Preddy, *J. Mar. biol. Asso. U.K.*, 1954, 33, 645)

A new method of calculation was therefore developed[5]; this depends on the fact that the mechanism which governs the dispersal of liquids discharged to the estuary governs also the distribution of sea water and fresh water. At the end of any given period the total amount of salt landward of any given cross-section will be that present at the beginning of the period, plus the net amount which has passed upstream through the cross-section during the period, plus any quantity discharged to the estuary during the same time landward of the cross-section. A similar condition applies to the movement of fresh water through the cross-section. These requirements can be put into the form of two equations involving the average salinity and average fresh-water flow during the period for which the calculations are to be made; by solving these equations the values are obtained of two quantities which define the proportions of a liquid discharged to the estuary at a given point which will pass respectively upstream or downstream of this point during a tidal cycle.

From these values, given the initial distribution of salinity and the fresh-water flow during a period, the salinity distribution at the end can be predicted. Examples of two such predictions for two periods of a fortnight, one in wet weather and the other in dry, are shown in Figure 2; the predicted and observed final curves are in satisfactory agreement. The same type of calculation can be used to follow the distribution of any material which moves with the water.

RATE OF OXIDATION OF POLLUTING MATTER

The rate of oxidation of settled sewages, sewage effluents, and industrial wastes representative of the discharges to the estuary, was determined in the laboratory, using a form of respirometer developed for this purpose[6]. In calculating the rate at which oxygen is utilized in the estuary by the constituents of a given effluent, one must also know the weight of oxidizable material discharged daily, and this can be obtained only from the records of the authorities responsible for the discharges. Here there is considerable difficulty, even when the records are complete. The weight of polluting material on any day is the product of the flow of the effluent and the concentration of oxidizable matter. As a measure of this concentration it has been usual to determine the '5-day biochemical oxygen demand'—that is the amount of oxygen obsorbed in 5 days when the effluent is diluted with water and incubated at a known temperature. Usually, however, in this test, while part of the carbon of the organic matter is oxidized to carbon dioxide, the nitrogen, originally present as ammonia or as organic nitrogen, is not oxidized to nitrate. This is because the oxidation of nitrogen during incubation does not usually start until some time after the period of 5 days of the standard test. There is good evidence, however, that in the estuary oxidation of nitrogen occurs almost immediately after discharge. To take this considerable factor into account, the results of the 5-day test were compared with those of much longer periods of incubation in the laboratory and the records were adjusted accordingly. Oxidation of organic matter by bacterial action may continue for lengthy periods—certainly for more than 80 days and sometimes for much longer than this[7].

It is clear that no single mathematical expression will define accurately the course of oxidation of a variety of types of organic matter during long periods in the estuary. Reviewing all the evidence, it is believed that comparatively little error is introduced if it is assumed that, immediately after discharge, oxidation of both the soluble organic carbon and nitrogen begins and thereafter follows an exponential course, the rate depending on the temperature, until all the carbon has been oxidized to carbon dioxide and all the nitrogen to nitrate.

SUPPLY OF OXYGEN

In the Thames, oxygen which is used in the oxidation of the polluting matter is supplied from a number of sources. The easiest quantity to determine is that which enters the estuary in solution from the upper river and, to a much smaller extent, from tributaries. Since the upper Thames is always well aerated, the weight of oxygen contributed daily is roughly proportional to the flow of the river. At very low flows the amount will be about 5 tons per day; at very high flows about 350 tons; and during 1950 to 1953 the average rate was estimated to have been about 70 tons per day. The quantity entering in tributaries is very difficult to determine, since many of these are polluted and their oxygen content fluctuates considerably; the average addition from these sources, however, is thought to be about 7 tons per day. Calculations show that the net quantity of oxygen entering from the sea is negligible, the amount of new oxygen entering the estuary in this way being almost exactly balanced by the amount lost in the seaward drift of the fresh water from the upper river and tributaries.

During the spring and early summer, considerable quantities of oxygen are supplied by the photosynthetic activity of phytoplankton, of which large numbers occur throughout the estuary. It is not known, however, whether the presence of algae increases the average amount of oxygen present during the year, since when the algae die and decay the organic matter liberated will require about as much oxygen for its oxidation as was liberated by photosynthesis during its formation. What the net effect of algal growth is on the oxygen balance will therefore depend on whether the algae are eventually oxidized within the confines of the estuary or not, and there is no quantitative information on this point. For want of better information it has been assumed that the presence of algae has no significant effect in the estuary as a whole, though it is realized that during any particular three-monthly period of the year they may cause a significant change in the oxygen level.

The largest amount of oxygen from any single source is that which is dissolved by the water from the air. It is, of course, impracticable to measure the rate of solution directly by reducing or increasing the concentration of oxygen present in the whole of the water in the estuary, and one is therefore driven to the use of less satisfactory and less direct methods of attack.

As in a fresh-water stream, the rate of solution of oxygen from the air at any point will be the product of the exchange coefficient and the oxygen deficiency at that point. The oxygen deficiency is known and the object of the methods to be applied is to determine the value of the exchange coefficient. In the

present work four methods of determination have been used, one direct and three indirect.

In the direct method a known volume of air was enclosed in a flexible polythene 'tent', about 1 foot square, allowed to float freely on the surface of the water. After an interval of one to two hours the gas remaining in the tent was removed, its volume was measured, and its composition determined by analysis. During the time the tent was floating the concentration of oxygen in the water below it was determined frequently and the oxygen deficiency calculated. From these data it should be possible to calculate the exchange coefficient. Unfortunately, while this method gives accurate results for still water, it is known to give values which are too high under choppy conditions, the reason being that the motion within the tent is more violent than that outside.

Of the indirect methods, two were very similar. In one the rate at which oxygen was being utilized at any point was calculated from figures supplied by the London County Council for the 5-day biochemical oxygen demand at that point. In the other, the rate of utilization during a period of only three hours was determined by incubating water in the dark at the temperature of the estuary from which each sample was taken. These two methods allow an estimate to be made of the exchange coefficient at the time and place of sampling, but both suffer from obvious disadvantages and no single determination can be expected to give an accurate result.

The fourth method was to consider the whole oxygen balance of the estuary making a balance sheet, with on one side the total weight of oxidizable material discharged to it and on the other the estimated supply of oxygen from the various sources. If all these sources except the contribution from the air are known, the latter can be found by difference. Then, knowing the oxygen deficiency throughout the estuary, the average exchange coefficient can be calculated.

It is perhaps surprising that in view of the not very satisfactory methods of measurement available, the values given by the four lines of approach were in reasonable agreement. From the consideration of the oxygen balance the value of the exchange coefficient was 5·7 cm./hr.; each of the other two indirect methods gave 6·9 cm./hr.; and the direct method, using flexible tents, gave 10·4 cm./hr., this value being known to be too high. In fresh-water streams, where the exchange coefficient can be measured directly and with reasonable accuracy, the values under different conditions cover a wide range—from about 5 cm./hr. for a slow-flowing lowland stream to as much as 200 cm./hr. for a hill-side beck.

In the Thames another large quantity of oxygen is made available by the reduction of nitrate by bacterial action. Part of this nitrate enters the estuary already formed in solution in the water of the upper river and in some of the tributaries, and in certain sewage effluents. Part, however, is formed within the estuary itself by the oxidation of ammonia discharged as a constituent of fresh water or of effluents, or formed by decomposition of organic matter. Nitrate is reduced, and its oxygen made available for oxidation only when the concentration of gaseous oxygen in solution falls below a certain value. Thus in

the Thames the nitrate is utilized in the central de-oxygenated zone. It is very difficult from field observations to determine the level of oxygen concentration at which nitrate is reduced, and these observations have therefore been supplemented with laboratory experiments in which the conditions can be accurately controlled. There is still a good deal of uncertainty about the matter, but the evidence from both observation and experiment suggests that reduction occurs without difficulty when the concentration of dissolved oxygen is between 0 and 5 per cent of the saturation value, but that it is not an important factor at concentrations higher than about 10 per cent.

Finally, in those parts of the estuary where oxidation is so intense that the water contains no significant amount either of oxygen or nitrate, sulphate is reduced to sulphide, thus causing the nuisance which it is the object of the survey to examine. It is very difficult to determine exactly the weight of oxygen resulting from the reduction of sulphate but it is believed to be small—perhaps some 30 tons per day as compared with an average of about 140 tons per day from reduction of nitrate and some 700 tons per day of gaseous oxygen absorbed from the air.

COMPARISON OF PREDICTED AND OBSERVED CONDITIONS

The calculations necessary to predict the distribution of oxygen in the estuary under a given set of conditions are very laborious and lengthy, but the principle of the method used can be briefly described. A U-shaped assumed distribution curve is first drawn to serve as a basis. At each of a number of points on this curve, corresponding to successive intervals of one mile from the head of the estuary, the changes in oxygen concentration expected to occur during one tidal cycle are then worked out. These changes result from the input of polluting matter during this time, oxidation of the organic matter present at the point, mixing of the water with that upstream and downstream of it, the effect of the seaward movement of fresh water, and the supply of new oxygen. The curve of oxygen distribution resulting from these various adjustments will generally be different from the basic curve. Using the second curve as a new basis the process is repeated until further changes corresponding to those occurring in a tidal cycle make no further change in the position of the curve. It is concluded that the distribution curve is then that resulting from the equilibrium of the various reactions concerned and, so far as the accuracy of the basic data allow, is that which would be found by observation after a long period under which the conditions had remained steady at the values chosen for the calculations.

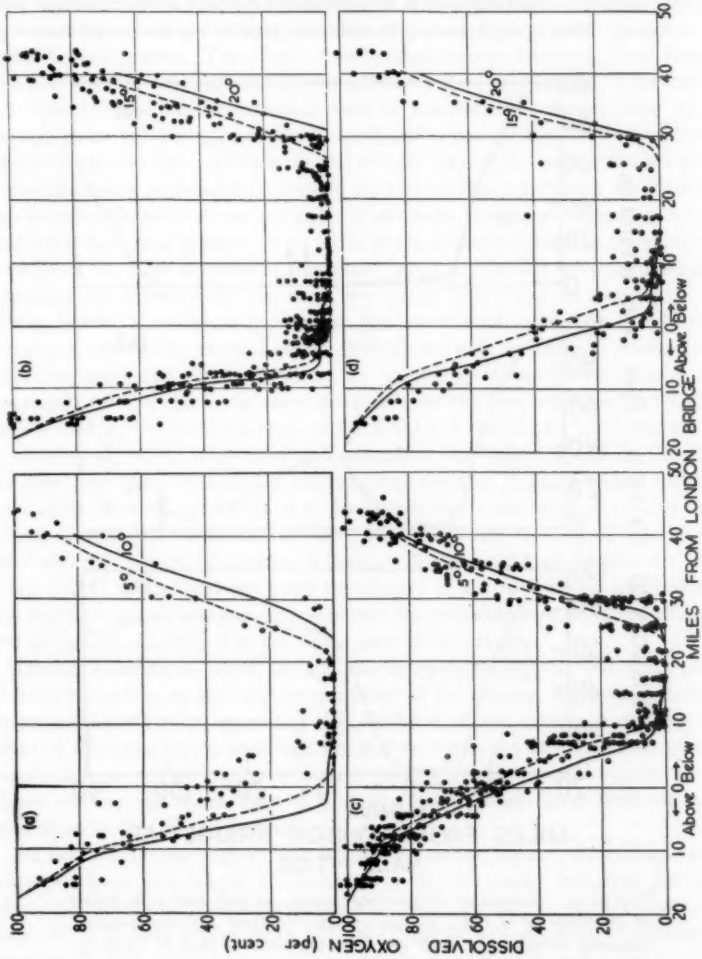
Typical examples of predicted oxygen distributions for different values of fresh-water flow and temperature, with results of direct observations under the same conditions, made by the L.C.C., are shown in Figure 3, which gives a fair indication of the accuracy achieved.

Although we believe from the large body of evidence now available that the method we have adopted is essentially sound, one matter which requires further investigation concerns the relative importance in the oxygen economy of the estuary of suspended and dissolved organic matter. A large quantity of mud

FIGURE 3. *Comparison of observed and calculated distributions of dissolved oxygen in the Thames Estuary for stated conditions of fresh-water flow and temperature.*

Period 1951 *to* 1955*:*

(*a*) *Flow* 500 *m.g.d.*; 5°C. to 10°C.
(*b*) *Flow* 500 *m.g.d.*; 15°C. to 20°C.
(*c*) *Flow* 1500 *m.g.d.*; 5°C. to 10°C.
(*d*) *Flow* 1500 *m.g.d.*; 15°C. to 20°C.



containing organic matter is dredged every year by the Port of London Authority and is dumped at sea. It is to be expected that part at least of this organic matter consists of material discharged as organic suspended solids in sewage effluents. If the material settled immediately to the bottom and remained there until it was later removed by dredging it would play no significant part in contributing to the deoxygenation of the water. Clearly it does not do this, since the water during the run of the tide, and especially during springs, always contains in suspension organic silt which can be shown to be responsible for part of the oxidation which is occurring. What is not known with sufficient precision is the proportion of this

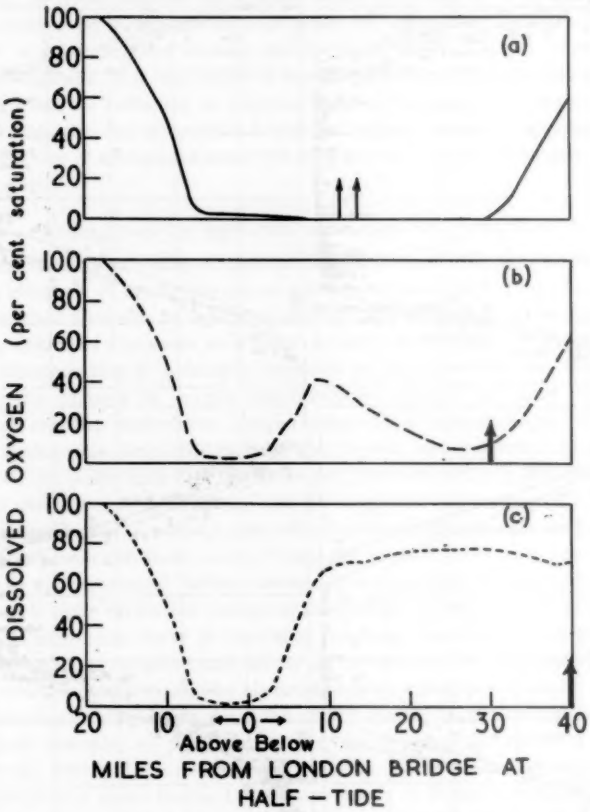


FIGURE 4. *Calculated oxygen sag curves, at half-tide with points of discharge of L.C.C. sewage effluents in three different reaches, assuming the polluting discharge to be the same as that in* 1950–53, *flow at Teddington* 500 *m.g.d., temperature* 20°C., *and exchange coefficient* 5·5 *cm./hr. Arrows show assumed position of discharges.*

organic matter which is oxidized during its retention in the estuary. The question is an important one, since in reducing the polluting load from sewage the first step is usually to increase the quantity of sludge removed at a sewage works.

In 1955 the London County Council brought into operation new sedimentation tanks at their Northern Outfall Works, and since then the quantity of insoluble organic matter discharged has been considerably reduced. The improvement in the condition of the estuary water, however, has so far been comparatively small, and it appears that the effect of the suspended matter entering the estuary before 1955 must have been considerably less than that of an equivalent quantity of soluble organic matter. The effect of suspended matter, however, is no doubt influenced by the amount of dredging carried out in the estuary. This varies from time to time and has changed both in amount and location since 1955. The figures are still being examined in detail and at present the effect of insoluble organic matter on the condition of the estuary cannot be accurately assessed.

Nevertheless it is possible to answer many questions concerning the Thames with some confidence. As an example, if the same weight of organic matter is discharged daily at a distance of 10 miles above London Bridge or at successive intervals of 10 miles seaward of this point, what will be the relative maximum reductions in concentration (in parts per million) of dissolved oxygen in the estuary water? The figures given from the calculations, assuming a reduction of 1 p.p.m. ten miles above London Bridge, are 0·52 at London Bridge, and 0·24, 0·10, 0·06, and 0·03 at points 10, 20, 30, and 40 miles seaward. During the nineteenth century there was some discussion on the best positions for the two outfalls now under the jurisdiction of the L.C.C. It would now be impracticable to move these, but it is interesting to calculate what effect would be expected had they been placed seaward of their present position. Figure 4 shows that had the outfalls been as far seaward as Southend, the concentration of dissolved oxygen in the estuary would not have been seriously reduced. These curves show also that the deoxygenation at London Bridge would not be removed even if the L.C.C. sewage did not enter the estuary at all; to improve conditions in this region it would be necessary to reduce the polluting load from the effluents and tributaries discharged to the upper part of the estuary.

Another question on which the analysis throws some light is that of the effect of fresh-water flow on the sanitary condition of the estuary. High flows do have an important effect in improving the condition of the estuary water but the effect of a comparatively small additional flow, when the flow at Teddington is already low, is not very great; it would cause a significant improvement in the upper reaches—say from Kew to Putney—but it would have little effect on conditions in the central reaches.

All the calculations suggest that when the London County Council has completed its large programme of extensions at its two works, including provision of further biological treatment plant, the condition of the estuary water will improve to a point where there will no longer be any significant evolution of sulphide in the central reaches. The data which the present survey has provided —for example, the expected effects of discharging a given quantity of polluting

material at a given position—should allow the estuary to be managed with a much better background of technical knowledge than has hitherto been available. The present survey has had to break much new ground and there are many aspects of the work on which much more information is desirable. The next few years, when such large reductions in polluting load are being made, will be a very valuable opportunity for testing the accuracy of the data on which the present calculations have been based and of the soundness of the methods of calculation themselves.

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DISCUSSION

MR. F. G. RUNDALL: We have had a most interesting account of the complexities which lead to the lack of oxygen in the River Thames and the evolution of sulphide. Dr. Southgate has shown the effect of a hypothetical change in the point of discharge of some of the sewage effluent. Assuming that the point of discharge must be as it is now, has he also been able to calculate what percentage of improvement in the organic matter discharged by these effluents would be necessary if the sulphide nuisance was to be abated? Do we have to halve the organic matter discharged, do we have to quarter it?

THE LECTURE: Yes. As you probably know, the London County Council is at present carrying out a very big scheme of extension of their two sewage works, which amounts, in the case of the Northern works, to putting in biological treatment for a large part of the sewage, and in the Southern works to giving complete biological treatment. We calculate that when that comes into operation the evolution of sulphide will not occur. But for all that, the Thames, like other estuaries, has a relatively small purifying capacity and we do not expect there to be a very big margin of safety. Other improvements are going on at the same time in works at the head of the estuary which have also been taken into account.

DR. J. H. OLIVER: I remember the bomb damage to the main sewage outfall in 1940, and its obvious effect on the appearance of the river at London Bridge. I wonder whether Dr. Southgate would express an opinion as to whether this massive infection of the bottom of the river completed an already deteriorating position from which it has never recovered.

THE LECTURER: Obviously there is a reservoir of organic mud in the Thames, but you cannot have it both ways. If it is an important factor it is being oxidized, but if it is being oxidized then it must have a limited life.

MR. C. J. REGAN: The question referred to the events of September, 1940, I think, when as a result of enemy action the main sewer on the north side was fractured and for about two or three days the whole of the sewage had to go into the river untreated. That undoubtedly accounted for the condition which then arose.

MR. N. L. ALLPORT: Can Dr. Southgate give any information on the effect of the tides on the distribution of pollution; whether the tides cause the pollution to go upstream?

THE LECTURER: Yes, certainly. Of the material discharged at a given point, some will be carried towards the head of the estuary during the flood tide, and of this,

part will be carried a further distance during successive tides. The upper limit, which it is possible to reach, is the point where the estuary water is wholly fresh.

MR. P. T. SHAW: Could Dr. Southgate say whether there is any evidence that the re-oxygenation of the river has been slowed down at all in the locality of refineries, as a result of spillage of oil or other matter on the surface preventing oxygen getting over?

THE LECTURER: I do not know, but we examined this point in the laboratory and our experience has always been that the effect of thin oil films on oxygenation is comparatively small—smaller than is often stated. Oxygenation is much more likely to be reduced by materials in the water—detergents, for example.

MR. G. VIVIAN DAVIES: I understand that the discharge from the various power stations situated along the Thames has quite an effect in raising the temperature of the water. Now I wonder if that has any influence on the problem ?

THE LECTURER: I did not mention this, but the maximum rise of temperature is a few degrees; this maximum rise occurs towards the head of the estuary and is not in the zone where the worst conditions occur. The rise is quite small compared with seasonal changes in temperature, and we think that the effect of artificial heating on the sanitary condition of the water is comparatively small.

MR. R. A. FRASER: I am very interested in this question of the effect of power-house water on river temperature. I should like Dr. Southgate's opinion as to whether such increases in temperature may affect aquatic life in the smaller rivers on which a number of power stations are situated.

THE LECTURER: I do not think that there is very much evidence. There is plenty of aquatic life in the Thames estuary; algae are present right through the polluted zone, and these produce oxygen by photosynthesis, even when the condition of the the water is at its worst.

MR. H. E. J. GREEN: I should like to raise the biological aspect of the question. It seems rather unlikely that lack of oxygen alone would be responsible for the reduction of sulphates to sulphides. It looks as though the anaerobic bacteria, or the biological bodies that are present, are the ones that are causing the trouble. Would it be possible to combat the present condition by destroying the agency which is responsible for the reduction?

THE LECTURER: I think not. The position is simply that the bacteria which reduce sulphate will only do so if oxygen in solution is absent, but what you are suggesting amounts to sterilizing the water. I should think that would be quite impracticable.

MR. M. MEEK: Has Dr. Southgate confined his investigations to the open part of the river? I am thinking now of the enclosed dock systems; can he say how the water in them compares with the water in the river outside?

THE LECTURER: Well, the water in them is taken from the most polluted parts of the estuary. Its condition is usually pretty poor because the rate of entry of oxygen from the air through the water surface in dock systems is probably less than it is in the estuary itself, where the water flows with the tides and is more exposed to the wind.

MR. MEEK: Can you say how the Thames compares with the Mersey? I am speaking from the point of view of ship-owners operating ships on the same run from both Liverpool and London as home ports. We have found that the ships operating from London are subject to more severe bottom rivet corrosion than those sailing out of Liverpool. To give an example of what is referred to, we have been faced with something like 30,000 rivet renewals in more than one ship operating from the Thames in the past eleven years. This, as can be imagined, involved a tremendous expense. Can Dr. Southgate say anything in explanation of this?

THE LECTURER: I have not got any up-to-date information about the Mersey. We made a survey of it in 1933–7 and I dare say it has got worse since then, but I do not know. The position then was that the part of the Mersey used by sea-going ships was in a much better condition than the Thames is now. The worst part of the Mersey was the upper estuary, but the navigable part, although polluted, contained a higher concentration of dissolved oxygen than does the Thames.

MR. L. C. BETTS: May I reply to the last speaker? Regular tests are taken, both of the river water and the dock waters, and almost without exception the dock waters are much better in quality than the river water—despite the fact that the dock levels are maintained by river water. For the most part the docks are fully aerobic; so much so, that crustacean life is present in large numbers. Under these conditions it is difficult to imagine abnormal deterioration in ships' rivets which could be attributed to the berthing of a ship in one of London's docks.

MR. M. I. JACKMAN: Has the lecturer any idea of the proportion of polluting load due to solids rather than to soluble matter?

THE LECTURER: Solids account for a good deal less than half.

MR. L. C. BETTS: I am very interested in this oxygen curve theory. Presumably an effluent can be discharged at a given point in the river and a graph plotted to show what its ultimate oxygen demand will be. That ultimate demand may never be satisfied in the river itself; it could be absorbed at sea before the oxygen demand is finally satisfied. The point which I should like to raise is that many effluents are involved throughout the length of the river, the constituents of which have an oxygen demand and could be salts in solution. The question is, bearing in mind the excellent mixing capacity of the tidal movement in the river, could it be that one salt would neutralize another? And if not, is the pattern fully predictable and accurate in terms of a curve?

THE LECTURER: One can, of course, think of effluents which would affect one another after discharge; for example, an alkaline effluent would neutralize an acidic one when they mixed in the estuary—but in practice most of the polluting discharges to the Thames contain natural organic matter of much the same general composition, and I do not think that they greatly affect each other during oxidation. In our calculations we have assumed that they do not.

COMMANDER A. M. COLEMAN: Does Dr. Southgate think there is any fear that efforts to cure pollution may prove detrimental to navigation by encouraging the temptation to dredge less?

The point is that when dealing with a navigable river, you want ships, but you don't mind about the fish so much!

THE LECTURER: I certainly do not think that efforts to cure pollution would affect navigation adversely.

THE CHAIRMAN: I feel that we have had a very interesting discussion and one which indicated quite clearly the interest which the audience has shown in Dr. Southgate's address. I think he bore out in his remarks what I said previously, namely, how difficult it must have been for him to compress the story of so large a volume of work into so small a space. I am sure there are many things that would have given you great additional interest if he had had time to deal with them.

A vote of thanks to the Lecturer was carried with acclamation and, another having been accorded to the Chairman upon the proposal of Sir Harold Saunders, the meeting then ended.

THE BIOLOGICAL CONTROL OF AGRICULTURAL PESTS

The Fernhurst Lecture by

GEORGE C. VARLEY, M.A., Ph.D.,

Hope Professor of Entomology, University of Oxford,

delivered to the Society on Wednesday, 15th April, 1959,

with E. O. Pearson, M.A., Director, Commonwealth Institute of Entomology, in the Chair

THE CHAIRMAN: It may seem strange to some of you that a lecture given under the auspices which are indicated in the title of the Fernhurst Lecture should be on the subject of the biological control of insect pests, but I do not think it is entirely surprising nowadays. Perhaps ten years ago it might have seemed stranger still that a Professor from Oxford should give a lecture on this subject under these auspices—it might have been said that this was a glancing reference to the old belief that Oxford was the home of lost causes and impossible loyalties! But things have changed during the last ten years; entomologists generally have realized that the hopes which were at that time expressed that chemical control would solve all our entomological problems have not been fulfilled, and that we should face the problem which has been created by the application of chemicals to the control of insects with some degree of humbleness.

It is in fact singularly appropriate that Professor Varley should give this lecture, because he has had a long experience of the problems of trying to decide precisely what are the factors which do control insect pests. He has the advantage of having been one of the first persons to study in detail the mathematical bases which underlie all efforts at control of insects; and although he approaches the subject from, if I may say so, an academic viewpoint, it is nevertheless realized to-day that it is only through a more thorough basic understanding of the factors that control insects, and therefore insect pests, that effective control can be achieved. To-day we have reached the stage where the chemical control of insect pests has thrown up innumerable problems which devolve upon other factors controlling insects. These are the biological factors, and it is on them that Professor Varley will speak.

The following lecture, which was illustrated by lantern slides, was then delivered.

THE LECTURE

We are all familiar with the prodigious reproductive rate of many insect pests; but it is often forgotten that those insects which are rare have similar rates of reproduction. These have their numbers stabilized by natural control factors at such a level that they do insignificant damage to the crops on which they feed. Either because the mechanism of population control is operating at too high a level, or because the normal mechanism has temporarily broken down altogether, the pests are numerous enough to cause economic damage. Where this is the case, the problem has been how to substitute for the inadequate natural control of the pest some other process, either biological control by the

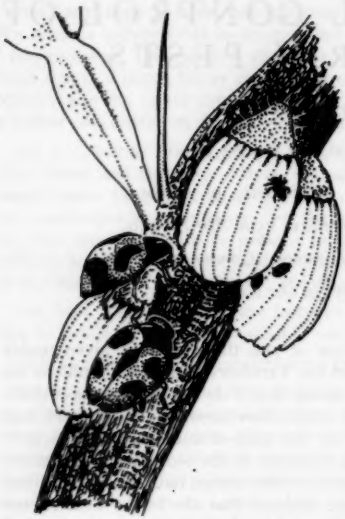

FIGURE 1. *Cottony-cushion scale insects* (Icerya) *on* Citrus *twig, with two lady-bird beetles* (Vedalia) *on the scale on the left; one scale on the right has two Vedalia eggs; on the upper scale is a young larva of the Vedalia beetle* (× 4)

introduction of beneficial insects which themselves destroy the pest, or chemical 'control' which involves the killing of the pests by various kinds of insecticide.

Let us begin by examining the first successful experiment in biological control. When orange groves were first planted in California many of the young trees were imported from Australia. There the cottony-cushion scale insect (or fluted scale, *Icerya purchasi*) was native. Its original food plants were various native acacias and other trees, and it had spread to the introduced *Citrus*. Some were accidentally carried to California, where the climate and the *Citrus* suited them admirably. These scale insects, which are almost legless and immobile relatives of the aphids, feed by fixing their sucking mouth parts into twigs and leaves. When fully grown they produce a copious secretion of white waxy filaments which form a fragile box in which enormous numbers of eggs are laid. A heavy infestation of the scale causes the death of the twig, or even of the tree itself; the citrus growers in California were threatened with ruin. Albert Koebele was sent by the United States Department of Agriculture to seek for parasites and predators of the scale in its native home. It is worth recording that this was achieved after Congress had refused a specific appropriation for the work. Various ruses were required to find funds and to overcome the rule that Government servants might not travel outside the borders of the United States!

Koebele's report[1] makes fascinating reading. He visited various citrus-growing areas in Australia and New Zealand, finding the cottony-cushion scale on various sorts of tree, but usually in very small numbers. Guided by local entomologists he found a few trees which were heavily infested and there he collected thousands of the scales and observed that they were being destroyed by a small fly (*Cryptochætum*) and especially by a red and black lady-bird beetle (*Vedalia cardinalis*). (Figure 1.) This beetle was seen laying large numbers of eggs beside and under the scales. The larvæ which hatched from them fed avidly on the eggs of the scale insect, or on other stages even up to the adult, and themselves turned into beetles in as little as thirty days. Wooden boxes, filled with twigs infected with the scales, the flies and the beetles, were placed in the ice room aboard a steamer and shipped to San Francisco. In 1889 just over 500 live beetles (and

some flies) were liberated on heavily infested trees in California and the spread of Vedalia was so spectacular that within a year it was obvious that a major success had been achieved. Soon the cottony-cushion scale as a pest was but a memory, and only by diligent search could a few specimens be found. Although both became uncommon, neither the scale nor the Vedalia beetle died out. When D.D.T. was used against an outbreak of the citricola scale quite recently the Vedalia beetle was eliminated locally, and soon serious outbreaks of cottony-cushion scale were reported! With a revised insecticide programme the beetles have been re-established.

The total cost of Koebele's expedition was less than $5,000. Nowadays costs are higher, but in contrast it has been estimated that it costs a chemical company something of the order of $1,000,000 to put a new insecticide on the market to-day.

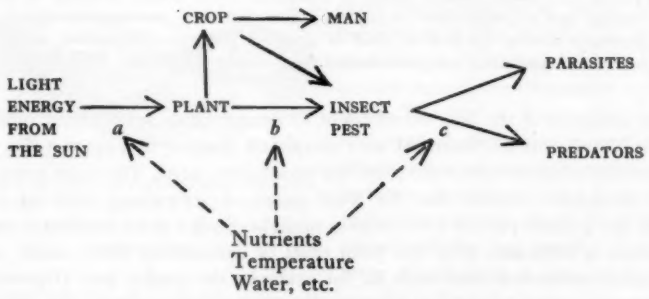

FIGURE 2. *Simple energy chain showing utilization of solar energy by plants and animals*

It is instructive to examine the problem of insect pests of agriculture with the aid of the diagram (Figure 2), which emphasizes the fact that agriculture is the art and science of converting solar energy into food (or some other product we can use) and that insect pests are our competitors.

The ability of plants to utilize solar energy depends on environmental conditions. The pecked arrow leading to *a* indicates that the presence of soil nutrients, water and suitable temperature greatly affects the percentage of solar energy which can be used. In temperate regions, over the whole year, the figure is far below 1 per cent!

The plant may be damaged or the crop spoiled by insect pests whose ability to multiply and utilize the energy in the living plant is also affected by climatic conditions and available nutrients. Adult insects, like the familiar cabbage white butterfly, may require to feed on nectar provided by plants other than those on which their early stages feed.

The third energy conversion *c* into the bodies of either parasites or predators is the one which most concerns us now. Here again, climatic factors must be

suitable and special nutrients may be needed. Hover flies, whose larvæ are predators of aphids, must feed on pollen if they are to lay many eggs. We have seen from the story of the introduction of the Vedalia beetle into California that where environmental conditions are suitable for the establishment of a predator this so regulates the pest population that the plant can utilize solar energy and produce a satisfactory crop.

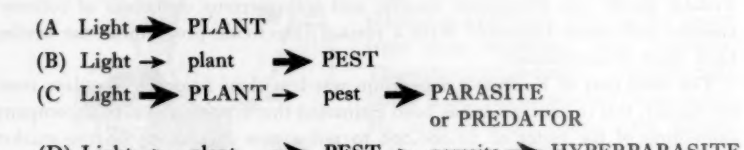

FIGURE 3. *Simple energy chains in which the thick arrows pointing to the terminal and alternate links (in capitals) show that these are dominant species, effectively limited by lack of food or available energy. Intervening species (lower case type) have a superabundant food supply which they cannot utilize*

The activities of the later members of an energy chain spread their influence up the chain; this is illustrated in a simplified manner in Figure 3. In 3 (A) we have the situation where the plant has no effective pests. The thick arrow and word in capitals indicates that the plant grows or reproduces until its leaves absorb the greater part of the available sunlight. Such a plant is either a natural dominant, a cultivated crop free from pests or competition from weeds, or an aggressive introduced weed such as, for example, the prickly pear (*Opuntia*) in Australia.

The situation in 3 (B) illustrates the result of the introduction from South America of the moth *Cactoblastis* whose larvæ mine the fleshy stems of *Opuntia*; this completely changed the status of the plant from that of an all-pervading weed to a relatively rare and harmless member of the Australian flora.

The status of the cottony-cushion scale in California in 1888 is shown by 3 (B) and the introduction of its predator Vedalia resulted in the situation 3 (C), where the thick arrows show that both the plant and the predator are very successful in converting the energy available to them, whilst the pest has a superabundance of food present but is unable to exploit it. The change in the environment due to spraying for citricola scale prevented the efficient multiplication of the Vedalia beetles and the situation temporarily reverted to (B). Likewise the accidental introduction of a hyperparasite or special predator of Vedalia might be equally unfortunate and result in situation (D).

In this greatly simplified model we see that alternate members of the food- or energy-chain are limited by their food supply. By adding a new effective link on the end of the chain the situation of all members of the chain is altered.

Whether any link in the chain is an effective one depends on the environmental conditions. DeBach[2] has reported that in California the extreme climatic conditions inland prevent the parasite *Aphytis* from controlling red scale on citrus

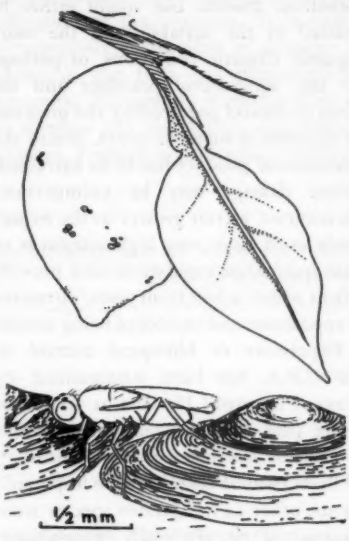

FIGURE 4. *Red scale* (Aonidiella aurantii) *on lemon* (× ½ *approx.*). *The parasitic wasp* Aphytis *laying its egg in red scale below* (× 30)

(Figure 4), whereas this parasite exercises efficient control of the pest in the more equable coastal groves. Applications of D.D.T. likewise inhibit *Aphytis* and the relatively resistant red scale can then defoliate the tree. Ants can also interfere with these parasites and 'farm' the scale insects for their sweet excreta.

The early successes of biological control were particularly numerous in the Pacific islands and especially in Hawaii,[3] where the Hawaiian Sugar Planters' Association showed great enterprise. They were able to control three serious pests and a number of minor pests of sugar cane by the introduction of beneficial insects. In Hawaii they have scarcely needed to resort to insecticide treatment at all. The first of these pests was the sugar-cane leaf-hopper, a sucking bug allied to our cuckoo-spit insect, which had been introduced from Australia late in the last century. Dr. R. C. L. Perkins introduced the egg parasite *Paranagrus* from Queensland in 1904 and in 1916 another egg parasite *Ootetrastichus* was brought in from Formosa. Between them they were very largely responsible for preventing further serious outbreaks. In the wetter winter season these parasites were inhibited and each year the leaf-hopper numbers rose somewhat, only to be brought down again by the parasites with the warmer weather.

The sugar-cane root grub, the larva of a chafer beetle *Anomala orientalis*, which came from Japan, likewise became very destructive, but the large wasp *Scolia manilæ* was found in the Philippines by Muir in 1916 and brought the pest under satisfactory control. Similarly the sugar-cane beetle borer *Rhabdocnemis* (Figure 5) was introduced about a hundred years ago from New Guinea, where it originally fed on the Sago Palm, but had transferred its attentions to sugar. Muir found in Amboina, Ceram and New Guinea that the beetle was attacked by a tachinid fly *Ceromasia*, no bigger than our house fly, whose larvæ destroyed the grubs in the cane. The species was introduced to Honolulu in 1910 and by 1913 was already beginning to reduce the pest population significantly. Since these early days many lesser pests have been treated by similar means in these and other oceanic islands. The paucity of similar successes in continental areas led to the once widely held view (in spite of Californian experience!) that biological control was a phenomenon restricted to oceanic islands. Clearly this could not be due to any sense of geography on the part of the

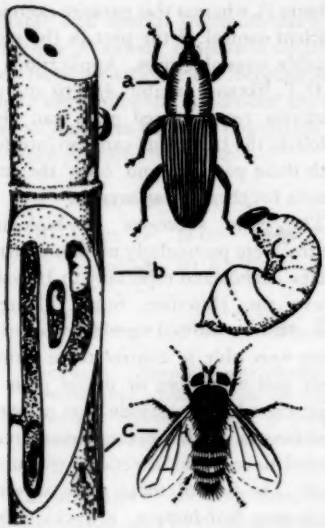

FIGURE 5. *Sugar cane partly split open to show damage by the New Guinea sugar-cane beetle borer grubs (left* × ½*); (a) adult beetles* Rhabdocnemis *; (b) beetle grubs; (c) the parasitic fly* Ceromasia *with (left) the cocoon of the beetle containing three puparia of the fly which have destroyed the beetle grub*

beneficial insects, but might either be related to the suitability of the more equable climatic conditions, or perhaps to the agricultural practices and the level of control required by the growers. If the crop is sugar or copra, where the commercial product has to be extracted, minor damage may be unimportant. In contrast, a fruit grower in the export trade must have very high standards to pass quarantine regulations and provide a fruit which is free from pests, attractive in appearance and capable of being stored.

Experience of biological control in the U.S.A. has been summarized by Clausen in 1956.[4] He lists 91 species of insect pest against which this method of control has been tried. Against 77 of them natural enemies were imported; for the other 14 indigenous species were transported or artificially propagated. Precise assessment of results is difficult to summarize, but I have tried to categorize them. Table I shows that there was considerable success with the control of fruit pests, but the results with field and garden crop pests were very poor. The only two successes were the use of a parasite and a virus against the alfalfa caterpillar (*Colias*) and a parasite from Italy against the alfalfa weevil. Alfalfa, like sugar as grown in Hawaii, differs from most field crops in being available throughout the year to its pests and their parasites. Perhaps it is the sequence of sowing, growing, cropping and ploughing which presents pests with a special opportunity and hinders beneficial insects from performing a satisfactory job of control?

Many of the most useful parasites of scale insect pests of fruit trees are tiny chalcid wasps like *Aphytis* on red scale of citrus, and *Prospaltella* on the San Jose scale of apple, etc. These parasites are extremely specific in their choice of scale insects, yet very difficult to distinguish from the many closely allied species. In some cases different races of the same species attack quite distinct species of scale. Clearly the greatest care must be exercised to avoid mistakes when introducing such beneficial insects.

Some fruit pests, such as the codling moth of apple, remain very serious in spite of all attempts at control by both insecticides and biological means. Apple orchards in the eastern United States receive up to 20 spray applications[5] each

year for various pests, although a spray-free period must be left to allow insect pollination of the blossoms. It is well known that different varieties of apple are unequally susceptible to damage; it seems that human selection for good flavour in the fruit has eliminated some of the plant's naturally acquired immunity. The greatly increased fruit size (compared with the wild crab-apple) has likewise put the codling caterpillar far from the reach of the ovipositors of parasites. Perhaps agricultural practice has made the codling moth a pest.

TABLE I

THE EFFECTIVENESS OF BIOLOGICAL CONTROL PROJECTS IN THE U.S.A. UP TO 1950
(*Data from Clausen*, USDA Tech. Bull. 1139)

	Fruit crops	*Field and garden crops*	*Forest and ornamental trees*	*Total*
Number of pest species ...	33	42	16	91
Number of pests effectively controlled*	12	2	4	18
Number of beneficial species established	55	20	35	110

* These figures are conservative, and do not include partial and local successes.

The egg of the codling moth is still available to parasites, since it is placed on the leaves or fruit. The well-known egg parasite *Trichogramma*, a minute chalcid wasp so small that it can complete its whole development within the egg of the moth, has been studied as a possible control factor. However, it appears to be of little practical use because its life-cycle is much shorter than that of the moth and unless there are alternative hosts its numbers cannot be maintained. Even artificial propagation in insectaries has been tried, but the liberated parasites did not help very greatly. Pickett[6] in Nova Scotia has revised orchard practice and greatly curtailed the spray programme, originally for economic reasons, but this has also encouraged beneficial insects. The fall in the incidence of codling moth under this treatment is most encouraging, but it is by no means fully understood.

The gipsy moth (*Porthetria dispar*) is quite a serious pest in Central Europe. For a time it was numerous in the fens of East Anglia, but became a collectors' prize when it became a rarity; attempts to re-introduce it were failures. In contrast, in 1869 it appeared in New England where it got quite out of hand, causing widespread defoliation of many kinds of broad-leaved trees. Over

FIGURE 6. *Japanese beetle* (Popillia) *on leaf it has skeletonized (above). The wasp* Tiphia *(centre) has just paralysed and laid an egg on the beetle grub (left); the beetle grub (right) is being devoured by a* Tiphia *larva (all* × 2)

40 species of parasite and predator were liberated to attack it and of these at least eleven became established and some of them are common. Whilst the gipsy moth outbreaks have been reduced in intensity and are now comparable to those in Europe, it is still serious in some years.

Another interesting case is the Japanese beetle (a relative of the *Anomala* of Hawaii) whose grubs feed on roots and are destructive to lawns and meadows. The major nuisance is caused by the beetle itself, which feeds voraciously on ornamental bushes and trees, which are stripped of their leaves (Figure 6). From Korea the large black *Tiphia* wasps were introduced. These dig down to the grubs, sting them and oviposit on them. The *Tiphia* larva then feeds upon the beetle grub and destroys it. *Tiphia* wasps have noticeably reduced the pest's numbers, but recently a new method of great promise has been used. A bacterium, causing a fatal 'milky disease' of the beetle grubs, can be propagated and sprayed like an insecticide. It seems to be specific to the Japanese beetle larvæ, but does not seem to spread much naturally and without re-introduction soon dies out.

So far in all the examples mentioned there has been little reason to doubt that pest mortality occasioned by natural enemies has been of benefit to the crop. That this is not always so has been demonstrated very clearly by T. H. C. Taylor in his account of the control of the coconut beetle *Promecotheca* in Fiji,[7] which is one of the most carefully documented in the history of biological control.

The beetle larvæ mine the coconut-palm leaves. A heavily damaged tree may fail to ripen nuts for two years, or even be killed. The beetle is widespread where coconuts are grown and normally has many overlapping generations, but only minor damage results. The larvæ are then heavily parasitized by various chalcid wasps, which have the apparent advantage of much shorter life-cycles than that of the host beetle. On the other hand, where outbreaks of the beetle caused serious damage, the beetles were all in one stage of development. All of them were in the larval stage together, then pupae and later adults were found. The usual parasites were quite unable to check the beetle's increase, because their lack of synchronization prevented them from finding suitable hosts in two successive generations. Freed from parasitism, the beetle increased until it had eaten out its food supply. Taylor's surprising discovery was that the one-stage

outbreaks were caused by an introduced mite, *Pediculoides*, with a life cycle of only 11 days and a very high reproductive rate. The mites suck the blood of the beetle larvæ and pupæ and kill them. This would be advantageous but for the fact that adult beetles and their eggs go unharmed. Although the mites may survive to kill some of the tiny beetle larvæ which hatch from these eggs, this food supply is too small to maintain a high mite population, which falls catastrophically. The onset of the wet season hastens the crash in numbers and the few surviving beetles, now unhindered by either their parasites or the mites, multiply rapidly to the limit of their food supply.

Taylor's cure was the introduction of another chalcid parasite, *Pleurotropis* from Java, chosen because its life cycle was approximately as long as that of the beetle. This parasite could therefore maintain itself in the one-stage outbreaks of its host. It had not previously been reported as a parasite of the Fiji beetle, but in its native home attacked other closely allied species; nevertheless, it adapted itself to the new conditions in Fiji and since then further outbreaks have not been reported.

Perhaps it would be misleading to say that biological control remains an art, and is not a science, since some of the properties required of a successful agent of biological control are well understood; but they are known for the most part only qualitatively. It is still impossible to predict quantitatively whether an introduced species will control a pest at a satisfactory level, or even to be sure that it will establish itself. There have been many disappointments. In the future I foresee a time when biological control and the use of insecticides as well will achieve their rightful place as the practical application of population science; but at the moment this science is in a very unsatisfactory state. There is a copious theoretical and mathematical literature, but the basic assumptions of the rival theories remain largely untested; whilst this is the case it is unfair to blame the practical men for working to rule of thumb. The population theories which particularly concern the biological and chemical control of insect pests are those of W. R. Thompson (until recently head of the Commonwealth Institute of Biological Control in Canada) and A. J. Nicholson (chief entomologist of the C.S.I.R.O., Canberra). The Australian authors Andrewartha and Birch, in their book on *The Distribution and Abundance of Animals*, disagree with both. These rival theories have all been recently re-stated and require very careful study in the original to be properly understood. Here, at the risk of distortion, I can only summarize their viewpoints.

Nicholson[8] considers that parasites and predators search for their hosts or prey 'at random' and their reproductive rate is determined by this food supply. He has constructed a mathematical model of the interaction of parasites and their hosts which predicts that a 'steady state' can exist in which the parasite and the host are in equilibrium. The level of this balance depends on the efficiency of the parasite in searching for hosts and on the natural rate of increase of the host. The balance is also considerably affected by both host and parasite mortality. Nicholson also predicts that the population density of both host and parasite should oscillate about the 'steady density', which various experiments have

now confirmed under controlled conditions. However, Nicholson expects that these oscillations should increase in amplitude until the population breaks up into small isolated pockets. This is observed in some instances in the field, but is not the general experience. Possible stabilizing influences have been suggested, but are not well understood and need to be investigated. If oscillations of population density occur, this theory suggests that when host density is high the individual parasites will lay very large numbers of eggs. In fact, the parasite egg supply is limited and, under these conditions, the theory put forward by Thompson may be closer to the truth.

Thompson[9] criticizes Nicholson's idea that the parasites search at random and prefers to consider that female parasites distribute a limited number of eggs amongst their hosts; the consequence of this view is that a species of parasite, if introduced as an agent of biological control, may increase geometrically for some generations; this has been partly confirmed by Thompson's observations upon the parasite of the woolly apple aphis.[10] Finally, however, the host should be exterminated; unfortunately this has yet to be observed! Thompson also frequently repeats the claim that animal species are controlled by their own intrinsic limitations; this could be interpreted to be a negation of the possibility of biological or chemical control!

Neither of these theories can be regarded as completely satisfactory, but since both have in part been confirmed, perhaps the truth lies somewhere between them. Andrewartha and Birch correctly stress the importance of climatic factors in causing changes in the distribution and abundance of animals, but have confused the idea of mortality with that of control or regulation, as indeed do many economic entomologists.

The question of which of these theories, if any, is correct is not just an academic one. The decision as to which parasite or predator should be introduced as an agent of biological control, or whether one species or many species should be introduced, depends on the theory held! If Thompson is right the parasite which will be effective in the shortest time is that which can lay most eggs. If Nicholson is right the efficiency of searching by the parasite or predator, especially its ability to maintain its numbers at low host (pest) population densities, is the important attribute. Although Nicholson's theory is now over twenty-five years old, I know of no attempt to estimate the efficiency of a parasite or predator before introduction.

An important and surprising deduction from Nicholson's theory is that the host equilibrium density is lower if the most efficient parasite is introduced alone, than if two or more less efficient parasites are introduced as well! This conclusion conflicts with the commonly held 'sequence theory', according to which the more parasite species that can be established the better. Believers in the sequence theory are still making multiple parasite introductions, which, if successful, are irrevocable.

We have seen that in attempting to control the gipsy moth in the U.S.A., a total of eleven species of parasites and predators were established. Now it is common experience that wherever an insect is abundant in a continental area

large numbers of species of parasite can be bred from it. Are we sure which is cause and which is effect? Are many species of parasite found because the host is abundant? Or is the host a pest because it had many species of parasites? These questions are so important that it is high time a serious attempt was made to put population theory on a firm basis. The results will affect not only biological control, but will help to put insecticide practice on a scientific basis too. They should both be regarded as methods of influencing a biological equilibrium. The work will cost money, but in my opinion this will be amply repaid in the long run by the reduction in the cost of food production. There is urgent need first for basic research on the feeding and searching behaviour of parasitic and predatory animals, especially those used in biological control. A beginning has been made in various laboratories, but a far greater research effort will be needed to establish the necessary facts.

Secondly, the purely practical work of biological control is severely hampered by our lack of knowledge of such insects as the tachinid flies and especially the parasitic wasps which are so largely employed. There is an urgent need for more taxonomic work on these insects. At present even the faunas on the two sides of the Atlantic have not been correlated in detail. Although biological control operates on a world-wide basis, a very high proportion of the potentially useful species are as yet unknown and many of those which are encountered can be named only to genera. It is not for me to say who should provide the funds for these projects, or whether they should be undertaken in universities or by other organizations; but I think there is a clear case that they will be of considerable benefit to agriculture as a whole. It might be argued that this was untrue for the British Isles, where biological control remains untried except for the pioneer work of Speyer at Wisley on the greenhouse white-fly. But recent estimates suggest that annual losses due to pests in this country may be as high as £50 million. The proper integration of biological and chemical treatments may be far cheaper and more effective than some of the methods in current use.

Biological control has one important long-term advantage over chemical methods. Where insecticides are employed it is inevitable that the process of evolution is against us. Many pests have already evolved strains resistant to the insecticides in use. With biological control there may equally be a selective advantage in the pests' increased resistance to the parasite or predator, but there is also selection in favour of more efficient parasites and predators. In their native home parasite and host will have reached evolutionary stability. Evolution is thus effectively neutral. However, in Canada and elsewhere scientists are exploring the exciting possibilities of breeding improved strains of parasites, just as we have improved the strains of animals and plants directly used in agriculture.

Biological control cannot provide an immediate remedy for a pest outbreak, even if a beneficial species is available for immediate colonization, whilst the employment of an insecticide must have an immediately favourable effect. However, practical experience and population theory agree that immediate and long-term effects may be entirely different. Progress in understanding these

effects will not be possible until fuller observations of the biological relationships between crop plants, their pests, potential pests, their parasites and predators are made by specially trained scientists with a clear idea of the theoretical basis of their work. The human mind is greatly limited by preconceptions. Facts which stare a man in the face may go unappreciated if they fail to fit with the theory held at the time. Reflected in the distorting mirror of a false hypothesis, the relationships between observations may be entirely misinterpreted.

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DISCUSSION

MR. J. H. STAPLEY (Research Station, Fernhurst): I should like to make some observations rather than ask questions. Professor Varley has given us what I would term the classical approach to biological control of insect pests (we appreciate, of course, that he is at present at Oxford!). I have had to face a more practical control and I should like to make two points in regard to biological control.

First of all, I do not think it is possible to choose one's pests very easily. Professor Varley described some of the examples as successes. I think the outstanding one was the control of the cottony-cushion scale. As he said, this was an outstanding success, but on the other hand there are pests which occur in this and other countries which do not yield to biological control. In this country for example, we have wire-worm and flea beetle, and Professor Varley mentioned codling moth. I think these are examples of pests which have not yielded to biological control. We know from experiences in South Africa, where during the war years it was impossible to get the chemicals to control the codling moth on the deciduous fruit and at the same time it was impossible to find markets in which to sell the fruit, so entomologists there turned their attention to the biological control. Unfortunately, their efforts were not very successful and when the war ended growers quickly went back to the use of insecticides.

I wonder whether Professor Varley's statement that twenty sprayings are needed is not a little out of date? I think this period goes back to the days of lead arsenic, and not to the D.D.T. days, because in South Africa only two sprays of D.D.T. are normally required for codling moth.

The second point I should like to make is that one must not lose sight of the objective in the control of pests. If you are talking about basic food crops like rice, cereals and maize, probably all you are interested in is producing a crop, and if you keep the pests down a bit as well, that is all right. One of the crops mentioned by Professor Varley was fruit, and in these days I think one can say the emphasis there is not so much on the crop itself as on the quality, so that it can be sold in world markets. In respect of the red scales—certainly most citrus-growing countries, such as Israel, export their fruit to Europe. For such countries it is not so much a case of keeping the red scale down to prevent conditions such as we saw on the photograph (which I think was an extreme case), but of preventing the red scale from

getting on the fruit at all. I do not think this degree of control will ever be achieved by any form of biological control. You must, I think, invoke chemical methods, and I would say that in these days, in the more civilized countries where there is a high standard of production of things like fruit, the emphasis must be rather on quality than just on production.

THE CHAIRMAN: We have with us this afternoon Dr. Simmonds, who has recently succeeded Dr. Thompson as Director of the Commonwealth Institute of Biological Control. You will have realized from what Professor Varley has said that there is considerable controversy about the effect which biological control may have, and I think it is possible to say that it may be approached in a scientific or an artistic way. I know that Dr. Simmonds is a scientist, and I think from the success which some of their ventures have had he must be an artist as well—perhaps he will tell us how he does it?

DR. F. J. SIMMONDS (Director, Commonwealth Institute of Biological Control): I do not know about telling you how we do it, but I think I may say that I am from the practical side of biological control rather than that of Professor Varley, the academic side, or Mr. Stapley's, the chemical side, of insect control. Most of what Professor Varley has said has been a plea for a more ecological approach to biological control, and I think we would all agree with that. But the ecological approach would include study of the general control of all environmental factors, and I think we ought to realize that resistance to chemical control is developing to a considerable extent, for example, in the codling moth. This question of two sprays only being effective in South Africa as opposed to twenty-two necessary in the eastern United States—which I think is not, as Mr. Stapley suggested, in connection with lead arsenic sprays but with some of the more recent types of chlorinated hydro-carbons—is due to a simple fact, that in South Africa resistance to these insecticides has not developed, whereas in the eastern United States it has.

I have just come back from the States and Canada, where they are very worried about the use of numerous sprays against the codling moth, and are considering again the somewhat discouraging possibilities of biological control. We are considering this on a somewhat wider and more intensive scale than has been done to date, with the intention that, if in five years' time the chemists have not found something to reduce the necessity for this number of sprays, then the research that has gone on in the meanwhile may have produced something which will give better biological control than some of these older parasites which have been tried. But here again, the parasites which have been tried in the past have been to a certain extent shots in the dark. We have investigated areas, selected parasites, collected them and liberated them without having any idea of the overall ecology of these parasites—what their secondary hosts are and what may be the effect of non-synchronization with the generations of the hosts, as pointed out as far as *Trichogramma* is concerned with the codling moth. Professor Varley says that it would be a very good idea if some of the effects of parasitism should be investigated before these parasites are introduced into new areas, and everybody would agree with this. I certainly should. The answer is, however, that nobody has ever provided the funds for this work. When we get a problem on our plate it is usually something that needs an immediate remedy. If Professor Varley can persuade anybody to provide funds on a long term basis, and say, 'We require no control for five years, but really try to get to the bottom of what the parasite ecology is', we should all be delighted, but unfortunately it does not work that way. As I see it, the main plea is for an ecological approach to this, from which we may get some correlation between theories of biological control, population dynamics, and the actual factors in the field. At the moment biological control is to a certain extent an art and not a science, because we do not have the basis for a scientific approach to the problems.

MR. P. K. SHAHANI: Does Professor Varley know of any biological control of the most devastating agricultural pest, the locust, and of the insects which attack paddy crops and mangoes? Also, I should like to ask him something about the white ants—if he has heard about them.

THE CHAIRMAN: Professor Varley would, I think, prefer to answer all the questions together at the end of the lecture. Meanwhile, I do not know whether anybody would like to pursue the fundamental point raised, namely, that of the attempt to substitute for qualitative ideas on how biological or other methods of control work, an approach to a quantitative method. I see Mr. Solomon in the audience, and I think perhaps he might wish to say something on this point as he has contributed very largely to the theory which lies behind it.

MR. M. E. SOLOMON (Pest Infestation Laboratory, Slough): I should certainly agree that research is needed, both on the pests themselves and on the insects it is hoped to use in their control. In each case we are concerned with populations, and the main problems are those of population dynamics—the interactions of populations and their relationships with the environment. In doing such work, one naturally deals in numbers, and tries to study the main relationships in a quantitative way. There is no mystery about what needs to be done. Investigations at Riverside (California), in Nova Scotia, at East Malling and at Rothamsted, for example, and Professor Varley's own research, show ways of approaching the problems. The difficulty is to get the backing to set up and maintain such time-consuming work on a big enough scale.

MR. D. PRICE JONES (Plant Protection Ltd.): Having known the speaker since he was about six feet one inch tall—I very nearly said, since he was knee-high to a dinosaur—I think I can claim the right to pass certain comments on his talk! But, speaking of dinosaurs, back in 1939, Dr. Varley, as he was then known could be seen striding across the East Anglian landscape like a modern Uffa, king of all the ploughed-up grassland he could survey. That, I think was one of the first instances of near biological control that I ever met. Not only were there probably millions of wireworms killed under his mighty foot, but the vast quantities of soil brought back to Cambridge must also have played a very big part in winning the war by depleting East Anglia of wireworms.

Rather more seriously, Mr. Chairman, the latter part of Professor Varley's talk brought to mind some work which was done from about 1935 to 1947, and some interesting lessons which I feel could be learned from the private life of the beet aphis. I should very much like to see Dr. Varley take an interest in that subject in the future. It is a fact that with the bean and beet aphis, certainly during the period 1935 to 1947, there was a very strong tendency for population peaks to be reached every second year, and of course troughs every *other* second year. The peaks might vary somewhat in height and the troughs just a little in depth, but the pattern was quite a strong one, up one year and down the next year.

The other pattern, which was equally striking, was one which could be recognized in any one field in any one year. The primary colonies which would normally start on the edge of the crop would be out of phase with those in the middle, a few weeks earlier in the earlier part of the season but perhaps only a few days earlier towards the peak of the season. But the governing factor is that it was possible to foretell what would happen in the following year roughly from the number of predators and parasites present at the end of the previous year. In fact, that tendency was so marked that I and probably other people often wondered why we went to such a lot of trouble to count eggs on spindle trees, which is really a very tedious and slow method.

Well, the two lessons that I have drawn from both those patterns is, firstly, that predators and parasites certainly played a very big part in keeping down the numbers of the aphid, but it is equally true that they certainly did not give anything like

perfect control of the aphid. If there is any general lesson to be drawn from that it is, I think, that we shall certainly have to lean quite heavily on chemical control, at least where viruses come into the picture; but at the same time I think that in the search for new aphicidal compounds we should try to make sure that they are as little toxic to the predators as possible.

DR. HARRY R. LILLIE: I have recently been studying the impact of man on his surroundings in countries overseas, and the question first crops up as to what we actually mean by the word pest. If you define a pest as any animal or insect which destroys more of the earth's natural resources in its lifetime than it repays for the benefit of future generations, then we come to the humbling realization that probably man is the only one which falls into this category.

Well, Professor Varley mentioned that we are sacrificing resistance to flavour in such products as apples. There I think is the key to a lot of what we are trying to get at. In Australia I found the fruit growers considerably worried. In Tasmania they told me that forty years ago, when they first immigrated, it was a most unusual thing for anybody to spray an orchard with any sort of chemical. Ten years ago, we were spraying approximately five times a year. This last few years we have been doing what Professor Varley mentioned they are doing in America, spraying up to twenty times in one season. The chemical producers will give the grower his programme for spraying in advance and the actual dates on which he should do it; and it has worked out at one spray every eight days through the growing period. Well, just as in Britain, they are concerned now that the continual spraying is destroying the soil bacteria, the soil structure, the earth worms, even the birds; and now the ground is compacting to the extent that the land is deprived of drainage and air, and trees are suffocating. This leads us to the other example another speaker mentioned, the locust problem. In Australia the same thing is happening. Since white men arrived there we have destroyed in vast numbers the birds that normally kept the locusts under control: the emu, the bustard, the ibis, that in a threatened plague gathered to eat daily almost their own weight of hoppers. I wonder if there is any record of there having been a case of a locust plague in the Middle East in pre-Biblical times before the desert-forming depredations of man!

With reference to chemical control, New Zealand agricultural men are definitely worried too that the rate of increase in diseases amongst livestock is going up steadily with the increased use of artificial fertilizers and chemical sprays of all sorts. What steps are we going to take to alter the thinking of this number one pest, man? I would ask Professor Varley if he thinks we are at last coming to realize that probably every problem that is occurring with so-called insect pests, is a problem for us first to ask ourselves what have *we* done wrong that this insect should be what we call a pest?

THE LECTURER: A number of very different viewpoints have been expressed, and I am glad to find that quite a reasonable number of them agree very closely with my own. I cannot hold out any panacea, naturally enough. My attitude to this is the humble one that at the moment we just do not fully know what we are doing, and that in spite of the reluctance of authorities to allow the biologists to do the research they want to do, we really ought to make an effort to try and see that this research is done. I remember discussing this with Professor Harry Smith in Riverside more than twenty years ago, and asking why it was that, although they were claiming success with biological control there was not a single published work which gave in detail the mechanism by which it had been achieved. His answer was perfectly simple—that the money was provided for other purposes. They had to rush and look at an orchard here and an orchard there, but could not employ any single person to investigate properly the course of the introduction of any new parasite since the money was not there. When you consider the reluctance which the United States Government showed in providing the funds for Koebele's rather successful effort

in the very early stages, we see how long this attitude of mind has persisted. I feel strongly about this: here we are monkeying about with things without knowing at all what the direct effects are going to be.

I cannot very easily answer all the questions in detail. I quite agree with Mr. Stapley that there are some pests (some of which I mentioned) which seem to be attacked by relatively few parasites or predators—I did not mention the wireworm, although Dr. Simmonds and I examined quite a lot of soil to count wireworms at one time—but these soil-inhabiting species have not yet been studied biologically. Quite possibly it may be demonstrated in the future, although I do not think it has been demonstrated yet, that chemical control is the best possible method of getting at some of them, but the experience in New Zealand (which is paralleled in the eastern United States) of the accumulation of toxic substances in the soil is a thing that we shall have to watch out for very carefully, and I submit that the testing of so many of these chemical programmes, just like the testing of the biological introductions, is completely inadequate. We do need this fundamental research. At present two or three theorists have fundamentally different ideas. If you are a follower of one, your course of action is of one kind; if you are a follower of another, your course of action is something different. Since some of these courses of action remain irrevocable once they are undertaken, you see how pathetic the situation really is.

Locusts and paddy insects and white ants were mentioned, but they are notoriously rather difficult to control at present. A beginning has been made on the study of locusts from a more biological angle. In the past they were not treated in that way, but I think that a change has been evident for quite a time and the Anti-Locust Research Organization has been fostering studies of the parasites and predators of locusts to see what is going on.

Mr. Price Jones raised some interesting points, but the Aphid observations he recalled are not published and that raises an important issue. All too often economic entomologists have valuable observations which have a bearing on the theoretical interpretation of population changes, but they remain unpublished, tucked away in people's minds or on their scribbling pads somewhere. I can only express the hope that this situation will gradually change.

THE CHAIRMAN: I think we all owe Professor Varley a very considerable debt for the extremely stimulating address which he has given to us this afternoon. He has put his view quite clearly; he has chastised everybody impartially, which is as it should be; it now only remains for anyone who has any influence in these matters to try to prevail upon governments, or possibly business organizations, to devote some proportion of their funds to solving some of the fundamental problems—they lie behind the practical efforts that both governments and commercial organizations make.

A vote of thanks to the Lecturer was carried with acclamation.

DR. E. HOLMES: On behalf of the Royal Society of Arts, of Fellows and visitors present, may I thank our Chairman, Mr. Pearson. For occasions of this kind success depends, first, on the choice of a good speaker, but almost as much on the choice of a good Chairman. We have been very fortunate in both this afternoon. I would thank our Chairman particularly for drawing attention to the fact that the sponsors of this particular series of lectures, obviously connected with the chemical trade, have thought it desirable to ask for a lecture on biological methods of pest control. Some people say that the chemical industry wants to sell chemicals irrespective of the results. I would say that no responsible chemical manufacturer wants to do that; he is trying to help the grower do a good job, and if biological methods of control and chemical methods of control are complementary, he is all for it. Thank you, Mr. Pearson.

A vote of thanks to the Chairman was carried with acclamation, and the meeting then ended.

A CENTURY OF BRITISH EDUCATION IN INDIA 1857-1957

The Sir George Birdwood Memorial Lecture by

PROFESSOR M. S. SUNDARAM, M.A., B.Litt.,

Education Counsellor, Office of the High Commissioner for India, delivered to the Commonwealth Section of the Society on Tuesday, 17th March, 1959, with Sir John Sargent, C.I.E., M.A., Hon.D.Litt., formerly Educational Adviser to the Government of India, in the Chair

THE CHAIRMAN: I have two reasons for feeling that this, from my point of view, is rather a special occasion. One is a sad reason: I am taking the place of a very old and dear friend of a great many of us, Sir Frank Brown, who unfortunately died only a few weeks ago. The second reason is a pleasant one: I have the privilege to preside at a lecture given by a very old colleague and friend of mine, Professor Sundaram.

Some years ago when I was in India (I think it was in 1942) and we were beginning to think about the question of education after the war, the government decided that at the centre there should be a separate Ministry of Education. Previously, as many of you will be aware, education, health and land all formed one large and rather cumbrous department. When it was decided that there should be a separate department of education it became one of my main duties to see to, or take part in seeing to, the recruitment of the staff. Professor Sundaram was one of the first people we persuaded to come and join us, and he has remained faithful to the administrative side of education ever since. When 1947 came, we were all rather wondering what particular form of service in the world of education would fall to his lot. I do not think I am far from the truth if I say that had he decided to remain at home he would have been by now almost certainly the Senior Administrative Officer in the Department. But he felt, I think rightly, that there was great work to be done as a Liaison Officer with countries overseas. The need towards the end of the war, and the problem also, was to find young Indians who could be trained to serve their new and independent country and, in so far as facilities for training were not available in India, to secure them suitable opportunities overseas. As you will appreciate, at that time the pressure on our own universities and on those in the United States was tremendous, and the job of finding openings for our young Indians was by no means an easy one. It would be hard for me to exaggerate the service which Professor Sundaram has rendered to his country and to individual Indians by his success in securing places for them.

He has, I know, after his two tours of duty in America (this is his second tour in this country as Education Counsellor) established a most cordial relationship with all universities and similar institutions. He is himself a good Oxford man, a product of Balliol. (He won't mind if I remind him that when he spoke Hindi, which is not his mother tongue, an irreverent member of our staff said that he spoke Hindi with an Oxford accent!) But as his success has grown so has his problem. In spite of the vast development in resources for training technologists, scientists and other people of advanced learning on India, the number of Indian students now being sent overseas for training is about three times what it used to be; so you can appreciate that the

person here who is trying to find for those young men and women appropriate places in this country against the abnormal pressure from our own people, and in America from young Americans, has by no means an easy task. His success in it not only means hard work, but what is even more important, an attractive and persuasive personality. I think you will find when he talks to you that Professor Sundaram certainly has the second, and I can affirm that when he was working with me he certainly showed the first.

The following lecture was then delivered.

THE LECTURE

Great Britain and India have a historic association of three centuries and a half. The first British explorers arrived in the Moghul courts at the beginning of the seventeenth century, and Britain officially withdrew from India in the mid-twentieth century. Indo-British contacts have played a prominent rôle in the shaping of the new India. When Great Britain quit India in August, 1947, as a ruling power, she left behind a rich legacy in many fields. A sound administrative system, a well-trained army, an incorruptible judiciary, and faith in the Parliamentary form of Government were among these; but all these legacies of Indian public life have an intimate connection with the educational policies that were developed largely under British auspices.

The year 1857 is an important landmark in the history of British education in India. The first modern universities of India were inaugurated in that year. Calcutta, Madras and Bombay celebrated their centenary in 1957. The expansion of university education was indeed slow. The fourth university was established for the Punjab in 1882; a fifth one was founded in Allahabad in 1887. India had only these five universities during the whole of the nineteenth century. It was only at the beginning of the twentieth century that the rulers of India showed serious concern about university education. In 1902 Lord Curzon appointed the first University Commission which reported on the state of higher education in the country. The Indian Universities Act of 1904 gave greater initiative to the five existing universities to improve their teaching functions, and to include inspection over affiliated colleges. The beginnings of organized research in universities were made about this time. It was only in 1913 that the British Government fully realized that the demand for greater university education could no longer be resisted. The principle that each of the Provinces is entitled to a separate university of its own was conceded. From that year not a decade passed without the founding of one or more universities. To list them chronologically: Benares, 1916; Mysore, 1916; Patna, 1917; Aligarh, 1920; Lucknow, 1921; Delhi, 1922; Osmania, 1922; Nagpur, 1923; Andhra, 1926; Agra, 1927; Annamalai, 1929; Kerala (formerly Travancore), 1937; Utkal, 1943; Saugar, 1946; Rajasthan, 1947. In the decade following 1947, no fewer than sixteen universities have been launched.

The purpose of this paper is not to give a historical or a chronological account of the rôle of British education in India. These could be obtained from any well-documented chronicle or history of Indian education. I am concerned primarily with the basic values in British educational thought and educational policies

which influenced not only the past history of India but also have continued to present certain problems vital to the future of the new India.

Indian educational policies were shaped by innumerable British leaders, administrators, educators, people in high authority as well as humble missionaries, religious reformers, publicists, propagandists and politicians throughout the three centuries of Indo-British relations. The early policy statements came in the form of Despatches and Charter Acts of the Court of Directors of the British East India Company. Many eminent persons who were deeply exercised about education in India have left their mark on the subject. Sir Thomas Munro, Mount-Stuart Elphinstone, William Adam, Lord William Bentinck, Charles Grant, Lord Moira, Lord Macaulay, Mr. Prendergast, Wilberforce, Warren Hastings, Lord Auckland, Sir Charles Wood, David Hare were among the pioneers of the first half of the nineteenth century. The great many missionary societies contributed their own special points of view to Indian education. Duff, Wilson, Miller, Hislop, Bishop French, Robert Noble, and many distinguished Roman Catholic priests and proselytizers, shaped Indian education in the same period independently of the Government of the day.

At no time in her long history has India had a system of compulsory universal public education for all children of school-going age. The concept of universal compulsory school education is comparatively new in terms of the history of any country—eastern or western. The principle of State responsibility for the education of its young citizens is not even a full century old. Britain's compulsory Education Act came into force in 1870 and 1876. It took nearly twenty years to educate public opinion in favour of accepting compulsion. During this period, India was directly under the British Crown, and the Indian Empire was fully integrated under British rule. If only Britain had introduced a Education Act for India similar to that of her own, there would be no problem of Indian illiteracy to-day. It was not as though the Indians of the time were not aware of the benefits of education. The damage to Indian education had occurred nearly a century before, when the Indian indigenous systems of education were allowed to die a natural death owing to lack of State support and the general apathy of the rulers of India.

India has had the longest tradition in Asia (along with China) of respect for learning and pursuit of knowledge. Professor F. W. Thomas observed: 'There is no country in the world where the love of learning has so early an origin and has exercised so lasting and powerful an influence.' And it is an irony of history that a people proud of centuries of traditional education and pursuit of knowledge and learning, with a history of many celebrated universities of the pre-Christian era, should have been found in a demoralized state of affairs in the seventeenth century. Yet India at no time had lapsed into primitivity or barbarism. The abodes of learning were kept functioning at all levels, even in the most turbulous times of internal civil strife. Our principal sources of information on the existing system of education in India in the early nineteenth century come from the surveys of Sir Thomas Munro in Madras, Mount-Stuart Elphinstone in Bombay, and William Adam in Bengal. The most that could be said of these is that they are

in the form of sample surveys. They covered only a small area, but it has to be presumed from a reading of these reports that the indigenous system of education was fairly widespread. Sir Thomas Munro wrote in 1822:

> It appears that the number of schools and what are called colleges in the territories under this Presidency amount to 12,498 and the population to 12,850,941; so that there is one school to every 1,000 of the population; but as only a very few females are taught in school, we may reckon one school to every 500 of the population. . . . I am, however, inclined to estimate the portion of the male population who receives school education to be nearer one third than one fourth of the whole, because we have no returns from the provinces of the number taught at home. In Madras, the number taught at home is 26,903 or about five times greater than that taught in schools. The practice of boys being taught at home by their relations or private teachers is not infrequent in any part of the country. The proportion of educated is very different in different classes. In some it is nearly the whole, in others it is barely one tenth.

Sir Thomas Munro concluded his report with a significant observation: 'The state of education here exhibited, low as it is compared with that of our own country, is higher than it was in most European countries at no very distant period.' Mr. G. L. Prendergast, a member of the Executive Council of the Governor of Bombay, made a glowing report on the state of literacy in his area:

> I need hardly mention what every member of the Board knows as well as I do, that there is hardly a village, great or small, throughout our territories, in which there is not at least one school, and in larger villages, more; many in every town, and in large cities, in every division, where young natives are taught reading, writing and arithmetic upon a system so economical, from a handful or two of grain to perhaps a rupee per month to the schoolmaster, according to the ability of parents, and at the same time so simple and effectual, that there is hardly a cultivator or petty dealer who is not competent to keep his own account with a degree of accuracy, in my opinion, beyond what we meet with amongst the lower orders in our own country; whilst the more splendid dealers and bankers keep their books with a degree of ease, conciseness and clearness, I rather think, fully equal to any British merchant.

Many indigenous schools worked on the monitorial system, the more advanced pupils tutoring the lower grades in each school. Dr. Bell, the Presidency Chaplain in Madras, commended this system for adoption in England. He called it 'the Madras system by which a school or family may teach itself under the supervision of a master or parent'. The system was used successfully in several parts of England.

A great deal has been debated as to the reliability of these reports and statistics of the day, and any discussion of the state of indigenous education at the beginning of the nineteenth century is at this date purely academic. Indians, proud of their heritage, indulge in nostalgic statements that education was widespread, while others take a dim view of the reliability of the surveys. The fact is established that India was by no means an uneducated country at the beginning of the nineteenth century. There was a network of autonomous, self-supporting decentralized school systems all over the land. The village priest and the village craftsmen played the rôle of teachers in addition to their religious and occupational pursuits.

British educational effort in India started off with one of the greatest controversies of all times. This controversy eventually turned out to be a setback to the whole process of Indian education. Under the first Educational Charter Act of 1813, the Board of Directors of the East India Company resolved that a sum of not less than 100,000 rupees in each year 'shall be set apart and applied to the revival and importance of literature and the encouragement of the learned natives of India and for the introduction and promotion of a knowledge of the sciences among the inhabitants of the British territories in India'. Two schools of thought known as the 'Orientalists' and the 'Anglicists' debated endlessly as to what type of schools should receive support from the company funds. There is still current a mistaken notion that education in the English language and through the medium of English was forced down on unwilling Indian subjects. Nothing is farther from the facts. There were many 'Orientalists' among the British, and many 'Anglicists' among the Indians. The Board of Directors at one time observed that the Hindus have as good a system of faith and morals as most people, and 'that it would be madness to attempt their conversion as to give them any more learning or any description of learning than that which they already possessed'. Warren Hastings was himself an 'Orientalist' who encouraged Sanskrit Pandits and Muslim Maulvis to pursue their traditional learning. The missionary pioneers who came out to India in ever-increasing numbers believed that western learning through the medium of a western language would win India for Christ. Charles Grant, who was the Chairman of the East India Company, ably argued the desirability of imparting education through the medium of English:

> The true cure of darkness is the introduction of light. The Hindus err, because they are ignorant; and their errors have never fairly been laid before them. The communication of our light and knowledge to them, would prove the best remedy for their disorders; and this remedy is proposed, from a full conviction that if judiciously and patiently applied, it would have great and happy effects upon them, effects honourable and advantageous for us. There are two ways of making this communication: the one is by the medium of the languages of those countries; the other is by the medium of our own. In general, when foreign teachers have proposed to instruct the inhabitants of any country, they have used the vernacular tongue of that people, for a natural and necessary reason, that they could not hope to make any other means of communication intelligible to them. This is not our case in respect of our eastern dependencies. They are our own, we have possessed them long, many Englishmen reside among the natives, our language is not unknown there, and it is practicable to diffuse it more widely. The choice, therefore, of either mode lies open to us; and we are at liberty to consider which is entitled to a preference. The acquisition of a foreign language is, to men of cultivated minds, a matter of no great difficulty. English teachers could, therefore, be sooner qualified to offer instruction in the native languages, than the Indian would be prepared to receive it in ours. This method would hence come into operation more speedily than the other; and it would also be attended with the advantage of a more careful selection of the matter of instruction. But it would be far more confined and less effectual; it may be termed a species of deciphering. The decipherer is required to unfold, in intelligible words, what was before hidden. Upon every new occasion he has a similar labour to perform and the information

> obtained from him is limited to the single communication then made. All other writings in the same character, still remain to those who are ignorant of it, unknown; but if they are taught the character itself, they can at once read every writing in which it is used. Thus superior, in point of ultimate advantage, does the employment of the English language appear; and upon this ground, we give a preference to that mode, proposing here that the communication of our knowledge shall be made by the medium of our own language. It would be extremely easy for the Government to establish, at a moderate expense, in various parts of Provinces, places of gratuitous instruction in reading and writing English: multitudes, especially of the young, would flock to them; and the easy books used in teaching, might at the same time convey obvious truths on different subjects. . . . *The Hindus would, in time, become teachers of English themselves; and the employment of our language in public business, for which every political reason remains in full force, would, in the course of another generation, make it very general throughout the country.* There is nothing wanting to the success of this plan, but the hearty patronage of Government. If they wish it to succeed, it can and must succeed. The introduction of English in the administration of the revenue, in judicial proceedings, and in other business of Government, wherein Persian is now used, and the establishment of free-schools for instruction in this language, would insure its diffusion over the country, for the reason already suggested, that the interest of the natives would induce them to acquire it.

I have quoted at length from Charles Grant in preference to citing Macaulay's famous minute of 1835, because Macaulay's gibes at the traditional learning of India contained no reasoned argument. Macaulay held up Oriental learning to ridicule in spite of the fact that his own countrymen were discovering the mystery and majesty of the Eastern scriptures. Fifty years before Macaulay wrote his minute, Charles Wilkins had translated *The Bhagavad Gita*. Sir William Jones had translated Kalidasa's *Shakuntala*, which went into five English editions within twenty years. The Government of the French Republic founded the first school of oriental languages in 1795, and Alexander Hamilton, a prisoner on parole in France, was appointed as its first Professor of Sanskrit. In 1832 Oxford established the first chair for Sanskrit, known as the Boden Professorship, with H. H. Wilson as its first incumbent. Judged by these events, Macaulay's denunciation of oriental learning did little damage to the study of eastern classics.

It may be pointed out that both the 'Orientalists' and the 'Anglicists' committed grave injustice to Indian education by taking extreme points of view. In the heat of the controversy both sides ignored that education of the masses of the people could be conducted adequately through the ordinary spoken language of each State or the mother-tongue of the pupil, with English being taught as an optional second language. But the Governor-General in Council adopted a Resolution that public funds would be expended only for the promotion of English literature and science, that no stipends would be available for students pursuing additional learning, no money would be spent on publication of books, in oriental languages. The Resolution took care to add that it was not the intention of his Lordship in Council to abolish any college or school of native learning. In fairness to the framers of the Resolution, it may be said that vast numbers of Indians were already converts to the benefits of English education, and the

missionary institutions were already working at full capacity imparting European learning. This state of affairs had led Macaulay to observe that 'We are forced to pay our Arabic and Sanskrit students while those who learn English are willing to pay us'. Books in Arabic and Sanskrit printed with a large public subsidy remained in the lumber rooms, while English text-books were selling in thousands at a profit to the publishers.

The Great Charter of Indian Education was to come in 1854 in the famous Wood's Educational Despatch. Missionary activity in education during the two decades preceding Wood's Despatch grew at a very rapid pace. Although in 1813 the Missions from Great Britain had the first preference, in 1833 Missions from other western nations were accepted without any restrictions. German and American Mission Societies entered the country in quick succession in the fervent hope that English education would lead to the spread of Christianity. The well-meaning and hard-working missionaries came to realize very slowly but surely that their expectations to win the masses of India for Christ were not to be realized in any spectacular way. The conservatism inherent in the ancient religions of Hinduism, Buddhism and Islam proved victorious against all the efforts of missionaries. A generation of English-educated Indians who studied Locke's *Letters on Toleration* began to dispute with missionaries in their own language on the importance of accepting all faiths as equally valid. In the midst of all the voluntary activity of the missionaries, there were some prophets of gloom who believed sincerely that education of the inhabitants would prove to be the political ruin of British power in India. Lord Ellenborough, the Governor-General, was one of them. Mid-nineteenth century liberalism had a tremendous impact on the Indian mind.

British educational policy in India was outlined elaborately in the Education Despatch of the Court of Directors, dated 19th July, 1854, known popularly as Wood's. It was the longest Governmental document known, consisting of a hundred paragraphs. It enunciated the aim of education as 'the diffusion of the improved arts, science, philosophy and literature of Europe; in short of European knowledge'. At the same time it laid down that the study of the spoken language of India was to be encouraged and that both the English language and the spoken languages of India were to be regarded as the media for the diffusion of European knowledge. It went on to say:

> It is neither our aim nor our desire to substitute the English language for the vernacular dialects of the country. We have always been most sensible of the importance and the use of the languages which alone are understood by the great mass of the population. These languages, and *not* English, have been put by us in place of Persian in the administration of justice, and in the intercourse between the officers of the government and the people. It is indispensable, therefore, that in any general system of education the study of them should be assiduously attended to. And any acquaintance with improved European knowledge which is to be communicated to the great mass of the people whose circumstances prevent them from acquiring a high order of education, and who may not be expected to overcome the difficulties of a foreign language, can only be conveyed to them through one or other of these vernacular languages.

The 'percolation theory' that western art and sciences would reach the masses of people through English-educated Indians was an illusory hope of the framers of the Despatch. While it is true that the literatures in Indian languages were never allowed to decay owing to disuse, almost three generations of concentrated effort went into the acquisition of English as a medium of communication. The Indian languages gradually ceased to be used in the higher spheres of administration, the judiciary, legislation and public life, with the consequence that they failed to develop the expressions and idioms pertaining to all these aspects of day-to-day life. Indian languages to-day suffer from a century of stagnation when phrases and words were not coined quickly to meet the demands of modern life and thought. Wherever the learned pundits had coined them, they were seldom used by the ordinary people because the English-trained classes held themselves aloof and apart from the rest of the community.

In the same decade as the Wood's Despatch, Japan came into contact with the Western World through Commodore Perry's incursion into Japanese waters. But Japan consciously set out to become a modern nation without having recourse to adopting an alien language. Gandhi made an effective comparison between India's backwardness and Japan's progress when he wrote in the *Harijan* as follows:

> The thousands of boys and girls in the Japanese schools and colleges receive their education not through the medium of English, but through Japanese. Their script is difficult but it is no bar to their learning it, and they have not given it up in preference to the Roman. Not that they boycott English and other European languages. But they economise their energy. Those who need to learn these do so for enriching the Japanese thought with knowledge which the West alone can give. They take care to turn into Japanese all that is worth taking from the West. The knowledge gained has thus become national property. The rapid progress of the Japanese was due to the restriction of the learning of the western mode to a selected few and using that for transmission of the new knowledge among the Japanese through the mother-tongue. Surely it is easy enough to understand that the Japanese could never have adapted themselves to the new mode if they had to do so through a foreign medium.

What Wood's Despatch failed to accomplish in one century, the makers of modern India have taken upon themselves to investigate and rectify. Having redrawn the political map of India on a linguistic and cultural basis, the principle of educating the masses through the medium of the mother tongue has been accepted by all the States. Both Indian and foreign educationalists used to be frightened at the complexity of the linguistic picture of India because of the vast number of languages in India. The Linguistic Survey of India in the 1951 census recorded the existence of 179 languages and 544 dialects in the country. In actual fact, the major languages of the country with adequate literature and historic continuity number only twelve in all.*

* They are named below ; the figures in brackets represent the approximate number speaking each of the languages : 1. Assamese (5 million). 2. Bengali (25 million). 3. Gujarati (16 million). 4. Hindi and Urdu (145 million). 5. Kannada (14 million). 6. Kashmiri (3 million). 7. Malayalam (13 million). 8. Marathi (27 million). 9. Oriya (13 million). 10. Punjabi (4 million). 11. Tamil (27 million). 12. Telegu (33 million). All other languages not mentioned in the list account for another 60 million people, mostly minor language groups and in tribal areas. Hindi and Urdu have a common structure and grammar, their main difference being that Urdu draws its vocabulary from Persian sources and Hindi from Sanskrit. Their script is also different.

A century of British education in India has now resulted in the old controversy being resumed in its new guise. We have to-day the new 'Anglicists', this time composed of Indians who are putting up a brave fight for the retention of English as the official language of the Indian Union. The framers of the Constitution of India adopted under Article 343 of the Indian Constitution 'that the official language of the Union shall be Hindi in Devanagari script'. They took particular care not to use the words 'national language' in describing the place of Hindi. It was also stated in the Constitution that 'notwithstanding anything in Clause 1, for a period of 15 years from the commencement of this Constitution the English language shall continue to be used for all the official purposes of the Union for which it was being used immediately before such commencement'. By the year 1965 India has to take a decision whether to continue the English language as the official language of the Union or whether to replace it by Hindi. The Indian Parliament has not taken an irrevocable decision on this vital question. They have been rather cautious and have decided to give ample opportunity for a public debate as to the future of the English language and its relative position *vis-à-vis* all major Indian languages. The President of India was also authorized by the Constitution to appoint 'at the expiration of 5 years from the commencement of this Constitution and thereafter at the expiration of 10 years from such commencement constitute a Commission to make recommendations on the language to be used as the language of the Union'. The first of these quinquennial reports on the official language policy was published in July, 1956, by a Commission constituted by the President in 1955. The British educationists of India may well be pleased to read in this Commission's report the following observations: 'Our knowledge of the English language is in fact the one legacy of British rule for which we have reason to be grateful more than any other; and since the British have departed and the English language could itself do no harm, it would be totally unwise to throw away this inheritance.' In another part of the report the Commission observe: 'We in India happen to have already a considerable measure of linguistic competence in the English language developed over a period of a couple of centuries of British rule and it would be wantonly foolish to throw away this advantage.' Thus the legacy of Britain to India has been very warmly acknowledged; but will this legacy endure forever?

We in India have had two centuries and a half of British education. Of this, one century was intensively devoted to advanced studies not only in the English language and literature but to intensive study of the British arts, sciences and technology. Innumerable institutions were developed on the British model. Most universities, old and new, from the year 1857, adopted English as a medium of instruction and examination, and for purposes of research. All primary and secondary schools throughout the country laid special stress on the mastery of the English language. In spite of this colossal effort, in the final analysis the number of those in the whole country who have acquired a reasonable competence in the use of the English language is estimated to be 3,800,000. Compared to the estimated 60 million literates for the whole of India, the fact emerges

that only 1·5 per cent of the literates can be counted as literate in English. At the same time the old percolation theory contained in Wood's Despatch has not proved quite valid because the knowledge acquired through English, particularly in a vast number of fields, has not been assimilated in the vocabularies of Indian languages. We are faced with one of the gravest dilemmas of Indian education to-day. The report of the Official Language Commission remarks facetiously, 'if by a sudden miracle we were all to forget our knowledge of English, the different linguistic groups in the country would become mutually unable to communicate with one another'.

In the earlier part of this paper reference was made to the failure of the British rulers to accept full responsibility for universal compulsory primary education for the children of India. At the beginning of the present century one great Indian statesman voiced his opinion that education should be the birthright of every child in the land, and that the State should accept full responsibility for this function. Mr. B. G. Gokhale made one memorable attempt to introduce compulsory primary education. In his capacity as a member of the Imperial Legislative Council he moved 'That this Council recommend that a beginning should be made in the direction of making education free and compulsory throughout the country, and that a mixed committee of officials and non-officials be appointed at an early date to frame definite proposals'. His programme consisted of three parts:

1. To create a Department of Education for the whole of India, with a Secretary at its head.
2. The cost of education to be shared between the Provincial and Central Governments.
3. An annual statement describing the progress of education to be included in the budget of the Government every year.

The Government of the day accepted the first and third proposals, but shelved the second. Mr. Gokhale returned to the charge the very next year, introducing another Bill to make better provision for the extension of elementary education. The non-Indian element in the Imperial Council voted against the measure of compulsion on the pretext that a foreign Government cannot afford the risk of unpopularity that compulsion may entail.

Not long after, in 1920, the British rulers of India shifted the responsibility for education squarely on to Indian shoulders. Under the Montague-Chelmsford Reform Act, provincial Ministries were asked to undertake responsibility for all educational expansion. While education became a State subject, finances for increased educational facilities could not be appropriated by the legislatures. Without financial support, responsibility remained ineffectual.

During the entire period of British educational effort in India, it had never occurred to any Secretary of State for India, or Viceroy, or Governor of an Indian State, to have a general survey made of India's needs on a national or even a provincial level. It is the last British Educational Adviser to the Government of India, Sir John Sargent, to whom belongs the honour of having presented the first draft of a report on the educational needs of India on an

all-India basis. In his foreword to this Report, entitled 'Post-war Educational Development in India', dated September, 1943, Sir John wrote:

> I have had a search made in the educational records, and although I have come across many valuable treatises on various aspects of educational development, I have discovered no previous attempt to show, even in broad outline, what a national system in the proper sense of the term would mean. I cannot help feeling that it is a good thing that such a picture should be painted and exhibited whatever its effects on the beholders may be. No apology, at any rate, is needed for presenting it at this juncture.

Sir John Sargent in presenting his Report threw out a challenge both to the people of India and to the Government when he wrote:

> In a country where apathy and inertia have reigned so long in the educational field and where poverty has been the accepted excuse for leaving undone what ought to be done, a prodigious effort will be needed on the part of those responsible both to set things going and to face the financial implications which such action will involve. Other countries, however, are already on the march towards the goal of social security, and if India continues to evade her responsibilities in this respect, she must be content to relegate herself to a position of permanent inferiority in the society of civilized nations.

What Mr. Gokhale failed to put through in 1910 and 1913, and Sir John Sargent produced as a comprehensive paper plan, the framers of the Indian Constitution of 1950 have accepted both as a challenge and an adventure in educational experiment and expansion. If the progressive countries of the world—the United Kingdom, the United States, Western Europe, Russia, Japan and the new China, could accomplish the task of universal compulsory education, nothing should stop India from setting her goal in that direction. Among the directive principles of the Indian Constitution, the founding fathers of Modern India set out that 'The State shall endeavour to provide within a period of ten years from the commencement of the Constitution free and compulsory education for all children until they complete the age of fourteen years'.

In the final analysis, India has been both a beneficiary and a victim of British direction of its educational policies. The British Empire in India was consolidated in the same period when Charles Dickens was exposing the iniquities of the social order in Great Britain. There were millions of poor, illiterate and disease-ridden people in the western world during that period of Indo-British relations when Britain was becoming strong as a political power over distant lands. The British-educated Indian of even average attainments assimilated many of the western values and western ethics with ease, but he could not comprehend why his country was still backward. Most educated Indians who learned about Christianity realized that it was not Christianity that gave superiority to western powers. Not many of the ruling class practised what Christianity preached. Then they turned to western nationalism as perhaps the secret of European superiority. The Indians did not even have an equivalent in their vocabulary to the western word 'nationalism'. This sentiment was alien to Indians. But they quickly realized that the only way to challenge European nationalism was to build up an Indian nationalism. The British-educated Indian automatically

became a strong nationalist. There were many shades of nationalism at the beginning—some willing to co-operate with the rulers, others eager to compromise, and still others rejecting all conciliation and demanding total freedom of action. Further inquiry revealed that it was not mere western nationalism that gave superiority to western nations, but western man's discovery of the use of the machine. It was because the Industrial Revolution had helped western man to produce much faster that he was able to dominate the Asian world. This Industrial Revolution has been the major factor in the western world between the eras of the French and the Russian Revolutions. So a century of British education in India set many Indians in ardent quest of the industrial age. 'Produce or Perish' is the slogan which is full of import to the Indian nationalist to-day.

The early Indian students who came in select numbers to British universities returned to India with a profound appreciation of the British ways of life. Many rose to high positions of responsibility in Government and public life. Still more became ardent nationalists and were devoted to the cause of India's social and economic advancement. With the dawn of freedom, Indians have undertaken plans of reconstruction on a magnitude never attempted so far in Indian history.

Since 1945 India has been sending thousands abroad in search of higher education and training. In any one academic year, we have about 10,000 Indian student nationals in overseas countries. The bulk of them, about 4,000, are to be found in the United Kingdom. The second largest group, numbering about 3,000, is in the United States. The remaining 3,000 are scattered in many other parts of the world, both in and outside the Commonwealth countries. The largest overseas group in the principal British or American universities happens to be Indian. At the height of the British rule of India there were not more than 1,500 Indian student nationals in United Kingdom institutions of higher education. And to-day, when Britain is no longer in charge of the destinies of India, India has nearly trebled that number.

At a time when all the resources of the country and its manpower are being mobilized for economic reconstruction at home, India cannot afford to maintain such large numbers of her young people in foreign countries. Their educational needs have got to be met by the institutions at home. In course of time, only those at the very advanced levels of learning, in the post-graduate and post-doctoral fields, should find it necessary to go overseas. This does not mean, however, that travel in itself has no educational value. While we should continue to encourage young university graduates to undertake study tours abroad, it would, in course of time, be economical for the country to stop the vast flood of undergraduates from going to technical and technological institutions in search of basic knowledge. India is well on her way to developing technology at home. Three new All-India technological institutes are being developed with the co-operation of the three advanced countries in Europe—Russia, West Germany and the United Kingdom. Under the Indo-American technical co-operation schemes, substantial numbers of technicians are being exchanged between India

and the United States. The Indo-German technical assistance programme is also in operation on similar lines. India is thus determined to catch up with the technological age. In their impatience for material advancement and a higher standard of living, some of our young people may be perhaps mistaking the economic superiority of the Atlantic nations for technological superiority and intellectual advancement. The 16 per cent of the world's population enjoying 60 per cent of the world's wealth may perhaps act as a will-o'-the-wisp for the millions of underprivileged peoples. India's educational goals cannot be reached by mere adherence to British methods, to which we have been accustomed for a long period. We have to experiment boldly in new ways and techniques, not forgetting of course the rich legacy of Indo-British collaboration of the last three centuries.

History has no parallel to the introduction and imposition for so long a period of the educational system of one country, with a totally different civilization, upon another country of a much older civilization. The whole pattern of Indian life and thought has undergone a change as a result of this experiment. It is entirely a matter of speculation at this date to say how Indian education would have developed had it not been influenced by British administration or British ways of life. We have two major developments as a consequence of our having been under the influence of the British—the problems of illiteracy, which had been left unchecked, and the problem of an enforced foreign language which we can neither abandon altogether nor continue to retain and develop indefinitely.

APPENDIX A

GROWTH OF COMMONWEALTH UNIVERSITIES BETWEEN 1939 AND 1958
(COMPARATIVE FIGURES)

	Universities and University colleges		*Teaching and research staff names*		*Number of full-time students*	
	1939	1958	1939	1958	1939	1958
Australia	6	10	800	2,300	9,000	19,000
Canada	20	30	2,800	7,900	38,000	78,000
Ceylon	1	1	30	290	600	2,500
Ghana	—	1	—	120	—	320
India } ...	18	35	2,100	5,700	130,000	736,087
Pakistan }		6		750		57,000
New Zealand ...	6	6	300	750	1,700	5,600
Singapore: Malaya	—	1	-	190	—	1,570
Union of South Africa	5	10	800	1,800	8,000	21,000
United Kingdom ...	21	25	3,800	10,500	50,000	97,000

APPENDIX B

PROGRESS OF EDUCATION IN INDIA
1947–57

	1947	1957
No. of primary and elementary schools ...	140,794	278,056
Enrolment	11,068,273	22,919,734
No. of secondary schools	12,899	32,567
Enrolment	3,020,598	8,526,336
No. of universities	21	34
Enrolment	228,881	736,087
	School Level	*School Level*
No. of technical and technological institutions	1,391	54,170
Enrolment	92,807	1,773,009
	Collegiate Level	*Collegiate Level*
No. of institutions	132	548
Enrolment	45,643	160,816
No. of colleges affiliated to universities ...	578	844
No. of teachers of all categories	561,000	1,218,000
No. of girls' schools	16,951	24,872
Enrolment	3,550,503	9,177,115
Percentage of literacy	14%	23% (?)

Expenditure on Education: (Major States)
States ... ... 205 million
Central ... ... 20 million

Total national expenditure from all sources was Rs. 551 million.*

* In 1956–7 the Central and State Governments budget was Rs. 1,798 million. Total national expenditure from all sources was Rs. 1,874 million.

DISCUSSION

MR. P. K. SHAHANI: I was glad to observe that the lecturer thought that 1857–1957 was 'a century of stagnation' for Indian education. Dr. Sundaram further observed that he felt that the two schools of thought 'Anglicists' and 'Orientalists' took extreme positions. But his views on Macaulay seemed to me rather outmoded, because I feel that Macaulay himself was an orientalist, for he could not otherwise have written six volumes of Sikh history!

I should like to ask the lecturer whether there was any person who took a middle way between the Anglicists and the Orientalists? I am referring here to Dr. Annie Besant, and to her work in the establishing of colleges in India (some have not survived), including the Banaras University, and also to the many books that she wrote, with which both the British and the Indians disagreed.

THE LECTURER: There were many intermediary shades of opinion. I did not say that these were the only two. The point that I was trying to stress was that the controversy which raged in the early part of the nineteenth century, and which came to a definite statement in the Wood's Dispatch, was not literally followed by the government. Wood's Dispatch was a splendid one, because it emphasized the importance of advancing education through the mother tongue, or the spoken language of the people. But they did not really follow it up by subsidizing the vernacular schools (as they used to be called) as liberally as they might have done, so that the emphasis was shifted from the Indian language schools to the English language schools, and the Indian language schools gradually vanished. Now that does not mean that there were not a large number of people holding independent views who carried on to the best of their ability education in the Indian languages; and as far as the result is concerned I would not say that all the languages died abruptly. The impetus for continued development did not exist, but quite a number of writers in Indian languages continued to write and expound. It was not 'a century of stagnation'—I did not say that at all in my lecture—the stagnation took place in two respects, in the way of increasing illiteracy and in diminution of interest in Indian languages.

MR. SHAHANI: Does the lecturer feel that Dr. Besant's views had any validity? Does he feel, for instance, that the Keele idea—the University College of North Staffordshire—could be easily copied in India?

THE LECTURER: I have a great respect for Dr. Besant and for the institutions which she founded. As an educational idealist she was a very sound person. I do not think that we could wholeheartedly support Dr. Besant's ideas of education because she was concerned with a new philosophy which she developed under the auspices of the Theosophical Society, which is not universally subscribed to throughout India, but that does not detract from her contribution to education. I certainly agree that in our university commissions at home the idea of a rural university has been stressed, and colleges like the University College of North Staffordshire could play a very important rôle if we could only develop such institutions for our rural areas.

SIR SELWYN SELWYN-CLARKE, K.B.E., C.M.G., M.C., (Chairman, Commonwealth Section Committee): Professor Sundaram has indeed given us an intellectual feast. He made the point that if compulsory education had been introduced into India at the same time as the Act of 1870 in England and Wales, there would be no problem of illiteracy to-day. I should like to remind Professor Sundaram that our Act of 1870 made it compulsory for local authorities to provide schools for children of not less than 5 and not more than 13 years of age, and that it took thirty years to add just one year to the upper age limit, for it was not until the Act of 1900 that children had to be kept at school until the age of 14. It took another forty-seven years to raise that age limit. For, although there was provision in the Education Act of 1944 for compulsory education up to 15 years of age, in fact it was not introduced until April, 1947. That is a total of seventy-seven years from the original Act of 1870. Bearing that in mind, and realizing the long-established organization of local authorities in this country, and the amount of funds and personnel and so on available here, I think that if you were to ask our educational experts at this moment whether there is still a problem of illiteracy in this country, they would say, 'Of course there is. Did you not read in *The Times* the other day that ten per cent of the recruits into the British Army in the Second World War were partly illiterate?' So, you see, after nearly 100 years of organized compulsory education we have not been able to liquidate illiteracy in this country.

I would suggest, Mr. Chairman, that in addition to the lack of some of the ordinary advantages deriving from the Industrial Revolution in Great Britain in the eighteenth and nineteenth centuries that perhaps do not exist in India, you there have something

like 179 languages and over 544 dialects to contend with. I recall from Professor Sundaram's lecture, that although you could reduce these languages to about twelve principal languages, in Urdu and Hindi there are two languages whose vocabularies are derived from Persian and Sanskrit respectively, and which have quite different scripts. With all those difficulties, should we not be a little generous towards past administrators and educationalists in India in their hesitation as to whether they should introduce compulsory education in India at the time it was introduced in this country?

I should like to say how greatly I admire the Government of India for having increased the amount of literacy by nearly fifty per cent in the ten years between 1947 and 1957. I think Professor Sundaram said that in 1947, when the British handed over the Government of India, there were something like 14 per cent literates, and now there are 23 per cent. That is a remarkable achievement.

THE LECTURER: I will make a very quick observation. My major case is that there is no mass illiteracy. There are illiterates in every part of the world, even in the most advanced parts, but the problem of mass illiteracy is the result of a neglected opportunity, of lack of legislation at the appropriate time.

Now with regard to the language problem, there is no need at all to be frightened because the linguistic survey of India lists each one of the minor languages, since the country, especially after its political map has been redrawn, is pretty well defined, with twelve leading languages; and one or other of these languages will absorb the minor variations and dialects. India is a large enough country to have twelve major languages. If the whole of Western Europe can have twenty-nine major languages I do not see why India, which is of the same size, could not have twelve major languages! That is not the problem. The resources of the country have got to be used very boldly by new legislation, which is imperative to-day in order to push on with educational projects. The half century that we have lost because of lack of similar legislation has resulted in the present position in India. I am not blaming any one for it, nor am I saying that what has been neglected can be achieved miraculously overnight. We need probably another fifty or sixty years to come anywhere near what Britain has achieved for her own educational system.

MR. H. H. HOOD: Am I right in assuming that the proceedings in the Central Parliament are still conducted in English? If so, supposing it was decided in the near future that the proceedings should be conducted in Hindi or some other Indian language, how long would it take for the proceedings conducted in that language to be understood by representatives from all parts of that great sub-continent, Hindustan?

THE LECTURER: Fortunately all international conferences to-day have the benefit of simultaneous translation from any language to any language, and I do not see any difficulty if even twelve languages are used in the Indian Parliament. In fact, a member of Parliament in India has the right to speak in his own mother tongue to-day, though others may not understand. By and large the majority of present Members of Parliament, who number 498 in the Lower House and 250 in the Upper House, still use English for their debates and so forth, but a reasonable minority insist on speaking in their own mother tongue. My own Minister for Education, who passed away some time ago, always spoke in Urdu in the Parliament; there were interpreters enough, and being a Cabinet Member he had to be listened to by other members. In a multilingual country like India we should not be unduly frightened by the complexity of the problem, nor can we use the steam-roller, and say that from such and such a date everybody shall speak only in one particular language. There ought to be some elasticity, and that is the way in which we are handling the whole business.

THE CHAIRMAN: I feel that we must stop now, if only that I may have the opportunity of voicing our very cordial thanks to Professor Sundaram for his address and for his answers to the questions which have been put to him. I feel that I have almost come back to the Indian educational scene myself this evening and am very tempted to make some further observations. I will only say that I do agree with Professor Sundaram as to what might have happened if the authorities in India had been more progressive, or perhaps one might say more venturesome, in their approach to the problem, not so much of education for the people who wanted, it but of education on a national scale. I think that education was regarded as rather a luxury right up to the end of our time. I saw it referred to by an important person in India, on an important government file, two years before 1947, as a 'frill'; I think that illustrates the attitude of a considerable number of people in authority towards the problem of bringing the 59 or 60 million Indian children under some form of compulsory education during their early years. But even if governments failed to produce education, I am glad that Professor Sundaram took the opportunity of paying a tribute to the many individuals, both Indian and British, who during the period under review laboured in that sometimes unremunerative but often most rewarding field. I am also glad that he referred to the very important contribution which was made by Mahatma Gandhi in the Wardha Scheme, by Rabindranath Tagore at Santiniketan, and many other people who laid the foundations upon which, I believe, the new government are now engaged in building. I am sure we all wish them success in their efforts to tackle what I suppose is one of the greatest problems facing any new country.

May I on your behalf offer to Professor Sundaram very cordial thanks for coming here and giving us what I am sure will be not the least memorable of the Sir George Birdwood Memorial Lectures.

The vote of thanks to the Lecturer was carried with acclamation and, another having been accorded to the Chairman upon the proposal of Sir Selwyn Selwyn-Clarke, the meeting then ended.

GENERAL NOTES

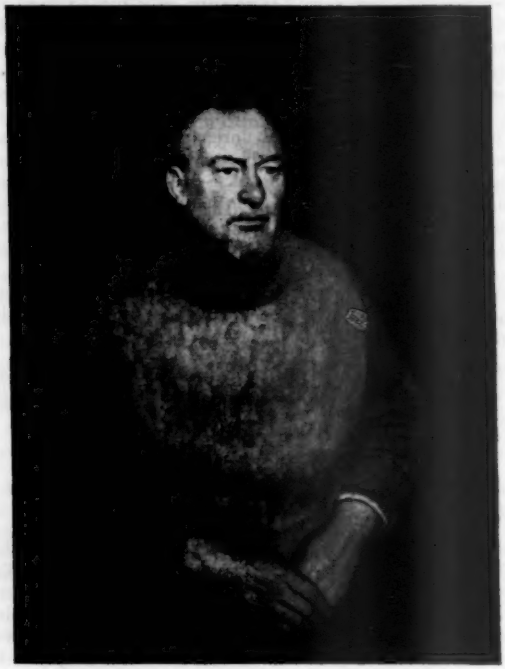
ROYAL ACADEMY SUMMER EXHIBITION

The increasingly contemporary look of the Academy Summer exhibitions—the mixing of 'leftish' with 'rightish' works nowadays in the main gallery, and the assertiveness elsewhere of those more adventurous painters who never dreamed of sending in before—may worry the Academy's more conservative public, though the change, I think, is ceasing to surprise it. That change, of course, was inevitable, and its rapidity in the past few years cannot have been due simply to the reiterated charges of art critics. Quite ordinary people are nowadays accustomed to serious Panel discussions, to the occasional experiments on radio and television, and, more significantly, they have come across excellent reproductions of Post-Impressionist and later modern masters. Such people were becoming uneasily aware that the Academy Summer exhibitions needed—as they would now admit—a good 'shake-up', and the efforts of the more progressive members of the Academic body are very apparent at Burlington House.

Thus the main gallery now presents a mixture unthinkable even five years ago, when the so-called 'moderns' were mainly relegated to the north-east rooms. Among the most ambitious, as they are also perhaps the finest things in the exhibition, are Professor Carel Weight's two religious paintings, which flank this year's centrepiece, A. R. Thomson's *Commemorative Dinner of the Royal Air Force, Bentley Priory*, an infinitely laborious set-piece, containing sixty-four portraits, in a style long

accustomed to these walls, which would have won Frith's heart. (That such a prodigious subject may still be tackled without inviting invidious comparisons, we might have recognized had the artist been in the tradition of Vuillard or Sickert, or even allowed himself something of the freedom of Mr. Gilbert Spencer.)

It may be debated whether Mr. Weight's *Entry into Jerusalem*, which represents modern figures in Malmesbury *en fête*, says very much more than his smaller painting on which it is based, lately shown at Zwemmer's Gallery. But the point is that this very fine and fanciful painter can fill even an unpeopled townscape with an air of watchful expectancy or foreboding, so that the larger scale is only justified, as it is here, when a very big mural has been envisaged. Mr. Weight's other painting, an



Ruskin Spear, R.A., *by Robert Buhler, R.A.*

intensely imaginative *Crucifixion*, clearly demands the setting of a church, though it must be owned that there are few parishes (outside perhaps those known to Mr. Stanley Spencer and Mr. Henry Moore) so enlightened as to care to possess it.

In the main room, one's glance also takes in two very workmanlike portraits by Robert Buhler, a typically intricate design by William Roberts depicting puppet-like soldiers wheeling before the Queen in *Trooping the Colour*, and Norman Blamey's view, from above the altar, of three priests prostrating themselves—all of them considerable paintings which give to this vast *salon* a sense of occasion. Elsewhere, too, the hanging has been so admirably contrived that the visitor is no longer, as it were, *enjoined* to concentrate on some popular 'picture of the year' set off by other productions very nearly as banal, if more muted. True, it is not easy to overlook the

essay, entitled this year *A Myth of Delos*, in the infinitely painstaking, quite sterile craftsmanship corresponding to those effigies in sand, shells and emerald weed, which unsung hands used to provide for our delectation beneath the promenade. But *A Myth of Delos*, with another, more sportive allegory here, belong to the Academy of '29, and they are all but submerged by the Academy of 1959.

They are all but submerged, in fact, by perhaps the most rewarding feature—the particularly good, honest portraits which allow one to ignore the several distressing ones. Everyone will welcome the return of Augustus John with two portraits, including the touching *Dorelia*. Everyone, surely, must recognize again Ruskin Spear's most searching characterization and understanding of cockney types, exemplified as much in his *Mrs. Tallis* as in his milling crowds and newsvendors at Fulham football ground. Indeed, the list of serious portraits of worth, including Stanley Spencer's, Henry Lamb's, and Christopher Ironside's rather Manet-like *Students in the Park*, could well be extended.

To dwell on the comparatively few good sculptures might be misleading, because, with the best will, the Academy cannot attract outside sculptors of consequence as readily as it is now attracting painters like Roy de Maistre, Henry Inlander or Stella Steyn. No one can doubt that sculptors of the stature of Moore and Epstein, and indeed our younger sculptors who are toured abroad collectively by the British Council, would be welcomed if they chose to send in. But the old antipathies remain. That might seem a pity, because a real effort has clearly been made this year to raise the standard by showing slightly fewer works, and sculptors like Charoux, Soukop, Gertrude Hermes and some lesser-known exhibitors deserve to be seen in challenging company.

There is a great reserve of quiet, serious painters on which the Academy continues to draw, and one of them, Mrs. Ethel Tolansky, has only lately been showing her oils at Walker's Galleries in Bond Street. Though her landscapes, townscapes, and figure studies are rather variable in execution, they are united by that high seriousness and prevailing sombreness of tone which one associates rather with the New English Art Club than with the run of works at Walker's. The daughter of a singer of international reputation, and receiving her early art training in Berlin, Ethel Tolansky has evidently learned much from studying Sickert in England. A three-quarter length nude reveals a much firmer grasp of form than her sleeping nude—a rich Sickertian essay which is unsatisfactory only in the lower limbs. *Evening in Putney* has a glowering and almost expressionist sullenness; but perhaps more characteristic is her spacious view of the Surrey Downs, well judged in tone and exhibiting a grave and questing talent which deserves to be fostered.

NEVILE WALLIS

1759—THE YEAR OF VICTORIES

'We have taken more places and ships in a week than would have set up such pedant nations as Greece and Rome to all futurity', wrote Horace Walpole to Lord Stafford in September, 1759; and a month later, to George Montagu: 'Can we easily leave the remains of such a year as this? It is still all gold. . . . Instead of the glorious and ever-memorable year 1759, as the newspapers call it, I call it this ever warm and victorious year . . . one would think we had plundered East and West Indies of sunshine. Our bells are worn threadbare with ringing for victories.'

That Strawberry Hill weather was not a universal blessing in 1759 may be seen from the contemporary log books of His Majesty's ships now lying open at the National Maritime Museum, Greenwich, where an exhibition commemorating those English triumphs which marked the turning point of the Seven Years' War is on view until the end of December. Neither of the two most important naval engagements of that year was fought in ideal conditions: off Lagos, Portugal, in August, where Boscawen destroyed the Toulon squadron, the winds favoured

neither side; in Quiberon Bay in November, where Hawke intercepted and defeated the Brest Fleet, thereby undoing French plans for an invasion of this country, the action took place in the teeth of a contrary gale, and Hawke observed that his losses were 'owing to the weather rather than to the enemy'. The difficulties of unfavourable or no winds, of distance and communications, the lack of reliable intelligence about the enemy's movements, make these feats of seamanship by the English admirals all the more heroic to modern eyes. A comparison of ship models arranged in Gallery XI illustrates another adverse factor in the struggle, and a general complaint of the time: that English ships were inferior both in size and speed to the French. The first part of the exhibition, moreover, which is devoted to the organization of the navy by the Admiralty and the Navy Board at this time, suggests that much was left to the discretion and initiative of the individual commanders—a policy more successful in respect of tactics than of personnel and maintenance.

Pitt, whose resolution and genius were impressed upon the whole effort of the war, presides in the first room of the exhibition at Greenwich; his captains are assembled in the farther gallery, where they look down upon the records and eye-witness descriptions of their exploits, set out in immaculate array. Operations in both the East and the West Indies are recorded, but the capture of Quebec takes pride of place. The exhibits—especially some delightfully realistic models of landing craft manned by sailors and redcoats—emphasize that the success of this operation was largely the result of amicable co-operation between the two services, notably between Wolfe and Saunders, who, as Admiral of the Fleet Lord Cunningham of Hyndhope observed when opening the exhibition on 6th May, has not yet been accorded a sufficiently high place in naval history. Saunders had been Hawke's second-in-command in the Mediterranean during the early part of the war. In February, 1759, newly made Vice-Admiral of the Blue, he was appointed to transport the army to the St. Lawrence, where his navigation of the dangerous narrows of the river, and subsequent blockade of the French garrison, aroused the wholehearted admiration of Wolfe. Too late to take part at Quiberon Bay, Saunders arrived in Dublin preceded by the news of that victory and of Quebec, and was publicly acclaimed. To his contemporaries he seemed the very embodiment of that sea-power which strikes the visitor to Greenwich with undiminished splendour.

DUNCAN GRANT EXHIBITION

A retrospective exhibition of works by Duncan Grant, R.D.I., is on view at the Tate Gallery until 21st June. The exhibition consists mainly of oil-paintings, water-colours and drawings, but also includes designs for fabrics, ceramics and furniture. Admission is free.

EXHIBITION OF SOUTH AFRICAN ART

An exhibition of painting and sculptures by South African artists, originally shown by the Union Government at last year's Venice Biennale, is on view in the Exhibition Rooms on the first floor of the Society's extension premises until 5th June. The works in the exhibition were chosen by the South African Association of Arts, and the artists represented include Walter Batties, Sidney Goldblatt, Johna van Heerden, Lippy Lipshitz and Irma Stern. There is no charge for admission to the exhibition, which is reached from 18 Adam Street, W.C.1, and is open on weekdays from 10 a.m. to 5.30 p.m. (on Saturday, 30th May, until 1 p.m.).

DESIGNS OF THE YEAR, 1959

H.R.H. the Duke of Edinburgh visited the Design Centre on 15th May to present certificates to the manufacturers of the sixteen products chosen as the 'Designs of the Year'. The certificates were awarded on the recommendation of a Selection Panel comprising Sir Colin Anderson, Hon.A.R.I.B.A., Hon.Des.R.C.A. (Chairman),

Mrs. Monica Pidgeon, Mr. Geoffrey Dunn, Mr. F. H. K. Henrion, M.B.E., F.S.I.A., and Mr. Jack Howe, A.R.I.B.A., F.S.I.A. As before, the judges were asked to choose designs from any of the categories of goods shown in the Design Centre during 1958 which, in their opinion, are outstanding for originality, workmanship, economy, or some other quality, and which make a real contribution to their respective industries. Their choice this year includes furniture, a carpet, woven and printed furnishing fabrics, a solid fuel room heater, a range of ceramic glazed tiles, a tea set, light fittings, a refrigerator, several tools and a camera tripod. All these products are on show at the Design Centre, 28 Haymarket, S.W.1, until 13th June.

This year also marks the first award of the Duke of Edinburgh's Prize for Elegant Design (see *Journal*, December, 1958, p. 54). In the course of the ceremony on 15th May, His Royal Highness announced that Mr. C. W. F. Longman, B.E.M., has won the prize for his part in designing the 'Packaway' refrigerator, which had also been selected as one of the Designs of the Year.

INTERNATIONAL PLASTICS EXHIBITION AND CONVENTION

A number of complimentary tickets for 1959 International Plastics Exhibition and Convention, which is to be held at Olympia from 22nd–24th June, are available to Fellows of this Society. Those who would like to take advantage of this facility should apply to the Secretary at an early date.

One of the special features in the exhibition is a display of well-designed plastics consumer products which have been selected by design organizations in eleven different countries. The convention, held within the exhibition, includes a session on Design Trends, at which Count Sigvard Bernadotte (Sweden), Dr. Ernesto Rogers (Italy) and Robin Day will speak.

'COMMUNICATION AND PERSUASION' EXHIBITION

From 23rd to 30th June the L.C.C. Central School of Arts and Crafts is staging an exhibition, entitled 'Communication and Persuasion', which has been devised to illustrate the training of designers for the advertising and publishing industries. The exhibition will include work by students taking full-time courses and will show the various ways in which students establish links with industry—from visits to printing houses and advertising agencies to complete projects tackled and professionally criticized. Also on show will be a selection of the work of men and women who have recently completed courses at the school. The exhibition is open on 24th–26th June from 10 a.m. to 7 p.m., and on 29th–30th June from 10 a.m. to 5 p.m.

BRITISH ASSOCIATION ANNUAL MEETING, 1959

The 121st Annual Meeting of the British Association for the Advancement of Science will be held at York from 2nd to 9th September, under the Presidency of Sir James Gray, C.B.E., M.C., F.R.S., Professor of Zoology in the University of Cambridge. Sir James's Presidential Address will be on the theme, 'The Proper Study of Mankind is Man'.

York was the birthplace of the British Association in 1831, and at this year's meeting the Anthropology Section will pay special attention to the history of the city. The section's President, Professor I. D. Richmond, will deliver the Sheldon Lecture on 'York before A.D. 1100—an Assessment', and there will be discussions and papers on the defences of Roman and medieval York, on the folklore of York industries, and on recent work on the geography of the county. Amongst the subjects to be treated in the Biological and Physical Sciences Sections are the Yorkshire flora and fauna, glaciation of the Vale of York, and the geology of the district.

In addition to the proceedings of the Association's fourteen sections, the arrangements for the 1959 meeting also include a programme of illustrated lectures for young people from schools in the area, a continuous showing of scientific films, and a variety of local excursions.

One of the principal objects of the Meeting is to provide for non-specialists an annual stocktaking of the progress of science in intelligible language. No scientific qualifications are required for membership of the British Association. Adults may join for a fee of two guineas each; students and schoolchildren, for 10s. each. Copies of the Preliminary Programme for the York meeting may be obtained free of charge from the Secretary, The British Association, 18 Adam Street, London, W.C.2.

COMPETITION FOR MANUFACTURERS' TRADE AND TECHNICAL LITERATURE, 1959

This year the Royal Institute of British Architects and the Building Centre are again jointly sponsoring a competition for trade and technical literature, other than space or prestige advertising, which has been written for and is directed to the architect. The competition is open to literature produced by manufacturers or merchants of building materials, by associations of such manufacturers or by any other bodies connected with the building trade.

Entries will be divided into two classes: 1. Literature offering technical information on the use and application of a product, products or services of a single manufacturer. 2. Literature consisting mainly of technical information on design, methods of application, standards of workmanship, maintenance, etc., as applied to a *group* of products or services, rather than to those of a single manufacturer. Conformity with British Standard 1311:1955, as amended in 1958, is an essential condition of entry in both classes. Every submission will first be judged for its general usefulness and appeal. If it is considered to be of the required standard, it will be included in the Trade and Technical Literature files of the R.I.B.A., and will be recommended for inclusion in the libraries of Allied Societies and Schools of Architecture. In addition, certificates attesting varying degrees of merit may be awarded in each class. As an indication of the standard set by the judges, it may be noted here that in last year's competition, when 83 firms submitted literature, only one certificate of 'exceptional merit' was awarded.

Full details of this competition, including entry forms, may be obtained from The Director, The Building Centre, 26 Store Street, London, W.C.1. The closing date for the receipt of entries is 15th October, 1959.

STUDIES IN THE SOCIETY'S ARCHIVES VI

THE SOCIETY OF ARTS AND THE LUNAR SOCIETY OF BIRMINGHAM (i)

In late eighteenth-century England, the only national and public organization deliberately to concern itself with problems of urbanization was the Society, instituted at London, for the Encouragement of Arts, Manufactures and Commerce. Through its concern with such problems, the Society of Arts found the trend of the future. While the universities continued to dream out their unreformed years, while Church and Parliament debated details of a way of life rapidly becoming irrelevant, and while the Royal Society gave up its concern with that immediately practical application of science which had been one of its *raisons d'être*, the Society of Arts busied itself promoting solutions to the problems suggested by a very practical-minded membership. It is no wonder then that the record books of the Society list as members or consultants industrialists who made little or no attempt to become active in other national organizations. Men like Arkwright, Baskerville, Boulton, Bentley, Garbett, Peel, Wedgwood and Wilkinson were interested in the approach to problems which the Society represented; they became members. Others, like the Taylors of Manchester, the Strutts of Derby, James Keir and John Whitehurst, might have no occasion to join the Society but acted as consultants. It is true that a few of these men also became Fellows of the Royal Society, but it is worthy of notice that their association with the Society of Arts began during the formative years of their careers, while, almost without exception, the 'F.R.S.' was achieved only after success had been reached.

The importance of the Society's immediate efforts at improving manufactures is hard to determine, but the indirect influence of its inspiration was enormous. Throughout provincial England, where the industrial revolution was really taking place, numerous local societies were formed, and most took the Society of Arts as a model. Even those societies bearing little or no resemblance to the Society of Arts were strongly influenced by it. The Lunar Society of Birmingham is perhaps the most famous of the early provincial societies. Since it represents almost a microcosm of the industrial revolution, it is not at all surprising to find that the Lunar Society had connections with the Society of Arts. What is surprising is to learn how many of these there were and how strong.

Of the fourteen persons known to be members of the Lunar circle[1], nine had some direct dealings with the Society of Arts. In some instances the connection seems almost trivial. Matthew Boulton, for example, became a member of the Society of Arts in 1782 and remained a member until his death, but the only record of active participation in Society business found for him is a letter of 22nd November, 1799, in which he supports the application of Charles Taylor to become the new secretary to the Society.[2] Appearances in this case, however, are probably deceptive. Boulton was a personal friend of Samuel More, long secretary to the Society of Arts; they corresponded, visited one another, occasionally travelled together. It is hard to believe that the Society was ignored during their association.

Another instance of deceptive appearances is that of Dr. William Small. Small was not a member of the Society of Arts; his one communication with the Society was a letter, dated 16th December, 1765, reporting on an iron drill-plough he had seen in operation near Birmingham.[3] This one letter would scarcely be worthy of notice were it not that it appears to be the only letter ever written by Small to an official organization. Dr. Small avoided public life. In his own circle he was very influential, but he had no ambition for notoriety outside those limits. Yet of all the early associates of what later became the Lunar Society it is probable that he was the most important. His was the personality that held together the diverse elements of that extraordinary group long enough for them to appreciate the union. It was at his death in 1775 that the Lunar Society was organized to replace his influence by the cement of semi-formal association. If Small looked with sympathy at the activities of the Society of Arts, one may be sure that other early members would tend to approve also. Incidentally, before Small returned to England from the Colony of Virginia in 1765, he had been professor of natural philosophy at the College of William and Mary, where he was Thomas Jefferson's beloved teacher. While in Virginia, Small was one of the subscribers to a bounty, promoted by the colonial legislature, 'for the encouragement of useful undertakings', which seems to have been a deliberate copy of the premium-giving policy of the Society of Arts.[4]

One of the persistent interests of the Society of Arts was the production of native alkali. Since alkali was used in the making of glass, soap, alum and saltpetre, in bleaching and as a fertilizer, it was in great demand and large quantities were imported. Many eighteenth-century chemists worked on processes of making alkali chemically, and Lunar Society members were among them. One of the most persistent of these experimenters was James Keir, who petitioned Parliament in 1780 for an exemption or drawback from salt duties. Keir's witnesses included Samuel More of the Society of Arts.[5] By 1781 Keir had established Tipton Chemical Works, one of the largest chemical manufactories in England, where he produced alkali from chemical waste by a secret process of his own invention. In March, 1786, the Society of Arts sent Keir samples of 'fossil alkali, brought from Bombay' to be tested. The report of his experiments and his rather unenthusiastic opinion of the value of that supply, in a letter dated 26th April, 1786, was printed in the *Transactions* of the Society.[6]

Another of the Society's interests was the standardization of weights and measures. In 1774 it advertised a premium of a gold medal or one hundred guineas as a reward

for a means of obtaining an invariable standard. This advertisement was repeated in 1776, 1777, and 1778. In 1779 Thomas Hatton, a London clockmaker, was awarded thirty guineas for his proposal based on the length of a pendulum.[7] John Whitehurst, clock and instrument maker of Derby, one of the earliest members of the Lunar circle, and recently appointed Stamper of the Money-weights, was invited by the Society to examine Hatton's apparatus. This was the occasion of Whitehurst's interest in this problem which ultimately resulted in his writing a treatise on the subject.[8] Other members of the Lunar Society, Watt and Priestley in particular, were also interested in standardization of measures, but do not appear directly involved with the efforts of the Society of Arts. On 10th February, 1785, Whitehurst again attended a meeting of the Committee of Mechanics to examine a new clock escapement which had been presented for their approval.[9]

One of the more obscure members of the Lunar Society was Dr. Jonathan Stokes, an ingenious man, Associate of the Linnean Society and author of several volumes of botanical works. Stokes was not a member of the Society of Arts; he does not seem to have been much interested in industrial matters, but he was interested in the agricultural aspect of the Society's work. On 20th June, 1785, he wrote a long letter to the Society of Arts in which he thanks the Secretary for information sent him, and mentions having seen a copy of the Society's *Transactions*. He makes several pertinent suggestions for the improvement of that work, suggests that the Society interest itself in botanical illustration, in encouraging the formal study of mining and mineralogy, and in the establishment of an herbarium of 'such plants used in arts, manufactures, or agriculture as are *not natives of this country*'. He then proposes that a premium be awarded for raising wool on light land by a method used in Herefordshire. These proposals were abstracted in a separate document, but do not appear to have been either printed or acted upon.[10] *(To be continued)*

ROBERT E. SCHOFIELD

1. Robert E. Schofield, 'Membership of the Lunar Society of Birmingham', *Annals of Science*, Vol. XII (1956), p. 118.
2. R.S.A. Loose Archives, B9/18. M. Boulton, 1799.
3. R.S.A. Guard Books, Vol. X, No. 60. W. Small, 1765.
4. William Waller Henning, ed., *Statutes at Large: being a Collection of all the Laws of Virginia from . . . 1619* (Richmond, Va., 1820), pp. 563 *et seq.*
5. *Journals of the House of Commons*, Vol. XXXVII, pp. 891–930.
6. *Transactions of the Society of Arts*, Vol. VI (1788), pp. 133–48.
7. Ibid., Vol. I (1783), pp. 239–49.
8. John Whitehurst, *An Attempt Towards Obtaining Invariable Measures of Length, Capacity, and Weight from the Mensuration of Time* . . . (London, 1787), reprinted in *The Works of John Whitehurst* (London, 1792).
9. All dated references to meetings of Committees of the Society of Arts are recorded in the appropriate minute books.
10. R.S.A. Loose Archives, A12/44. J. Stokes, 1785.

OBITUARY

MR. E. M. RICH

Mr. Edmund Milton Rich, C.B.E., died at Beckenham on 14th April, at the age of 84. He was a Vice-President of the Society from 1942–7, and again (after an interval of three years as an ordinary Member of Council) from 1951–4.

Dr. R. W. Holland writes:

Mr. Rich's passing leaves a void in a small band of educational administrators and practitioners. He was born on 12th July, 1875, and at the age of 20, after a technical

education at the Central Technical College, South Kensington, he became a Demonstrator in that College. His experience in education included Science-teaching at Owen's School; at the age of 24 he transferred to Organization, where he controlled the Science classes for the Staffordshire County Council, and shortly transferred to the Department of Agriculture and Technical Instruction in Ireland under Sir Robert Blair. He joined Sir Robert in London in 1905, and for the next 35 years served the London County Council Education Authority in the Elementary Branch in Technology; during his last seven years of service to 1940 he was Chief Education Officer to the Council. He drew on this wide experience when surveying the history and prospects of 'Technical Education' in a valuable paper read to this Society in 1941.

Rich was a valuable Member of the Society's Council, which he represented for a number of years on the Chadwick and Armstrong Memorial Trusts. He possessed a genius for making and retaining friendships amongst those with whom he worked. I know of two such, both of whom exceeded fifty years standing, who retained their affection and esteem for him until the end; doubtless there are others who can make a similar claim. This is all the more remarkable because it was inevitable that, within the work and direction in the high offices which E. M. R. held, differences of viewpoint and opinion should arise.

This sense of fellowship emerged conspicuously whenever anyone was in difficulty or trouble: his *first* reaction was always a sympathetic one : but, if subsequent action was demanded, it was because principles had been transgressed (which could not be defended). His motto could have been *audi alteram partem* for, whenever complaints were brought to him, he always insisted on obtaining both (or more) views of the situation before he declared his decisions.

During the First World War he (with one of his colleagues) offered their services to a farmer whose 'hands' had been called up for military service and whose harvest, in consequence, was in jeopardy. Again his adaptable fellowship emerged, for the farmer was very reluctant to release him when the harvest was safely in the ricks.

The lighter side of life was always acceptable to him: he enjoyed a good story and was ever ready to recall another. It was this quality which, so frequently, created the atmosphere of kindly understanding in which he could work (wherever he was) to the best advantage of the public which he so faithfully served during his long life.

MR. C. H. ASLIN

Mr. Charles Herbert Aslin, C.B.E., President of the Royal Institute of British Architects in 1954–5, died on 18th April, aged 65.

A native of Yorkshire, and educated at the University of Sheffield, Aslin held his first major professional appointment at Rotherham, where he was architect to the county borough. He subsequently spent three years in a similar capacity in Hampshire before moving to Derby as borough architect in 1930. Here he carried out extensive municipal works and improvements in the centre of the city, and showed to advantage both the vigour of his ideas and his capacity for organization. It was these qualities which underlay his success as county architect to Hertfordshire, a post to which he was appointed in 1945.

The Education Act of the previous year had made the provision of new school buildings a national problem; one generally complicated by the prevailing scarcity of labour and materials, and particularly pressing in a thickly populated county like Hertfordshire. To meet this situation, Aslin decided to employ prefabricated units made of light-weight steel frames, with a sheet or slab covering. This method had the advantages of speed and cheapness, but because it was novel it involved complex manufacturing difficulties. Aslin and his assistants were entirely successful in overcoming them. Within a few years, the Hertfordshire school-building programme had aroused widespread interest and admiration, the results were agreed to be both durable and attractive, and Aslin, by demonstrating that mass production in building did not

necessarily mean drabness and uniformity, had brought about a new approach to design and construction techniques. In May, 1954, shortly after the hundredth Hertfordshire school to be built since the war was completed, Aslin made this changed attitude to 'The Design of New Schools' (*Journal*, Vol. CII, p. 804) the subject of his Alfred Bossom Lecture to the Society. On this occasion also he pointed out that the increasingly heavy building responsibilities of local authorities were part of the force that was modifying the pattern of his profession. He took full advantage of his year of office as President of the R.I.B.A. to emphasize the significance of this development, and the consequent need for a reappraisal of the training and prospects of architects practising in Great Britain.

Mr. Aslin was elected a Fellow of the Society in 1955.

MR. JACK BEDDINGTON

Mr. Jack Beddington, C.B.E., Hon.F.S.I.A., who died on 13th April at the age of 66, exercised a formative influence on the æsthetic development of advertising in this country.

John Louis Beddington was educated at Wellington and Balliol. After the First World War, in which he was severely wounded whilst serving with the K.O.Y.L.I., he went out to China and worked there for an affiliate of the Shell Petroleum Company until 1928. Obliged by ill health to return home, he was appointed Publicity Manager in the London office of the Company. Beddington thus entered advertising by way of business administration, and his creative enthusiasm rested always on the basis of practical possibilities and necessities firmly grasped. None knew better that the purpose of advertising is to sell, but he also perceived that this object, and public gratification besides, could fitly be attained through the medium of the contemporary arts. As publicity manager (and later assistant general manager) of a great and expanding business he was well placed for exercising a discriminating patronage of painting, the art in which he took especial delight. In the 1930s he commissioned designs for posters and advertisements from a number of young artists whom he thus helped to achieve recognition: amongst them Barnett Freedman and McKnight Kauffer (both of whom subsequently became members of the Faculty of R.D.I.), Paul Nash, Graham Sutherland and Rex Whistler. The appeal which work by artists of this quality carried was accented by the slogans Beddington introduced at this time: 'That's Shell, that was' being perhaps the best remembered.

Beddington carried this vitality and ready discernment into his work as Director of Films for the Ministry of Information from 1940–6. He gave the late Humphrey Jennings one of his earliest opportunities, whilst *Desert Victory* and *The True Glory*, produced for the Ministry in these years, set a standard for documentary-propaganda films that is unlikely to be surpassed. For his work in this sphere Beddington was made C.B.E. in 1943. After the war he became a director of the advertising firm, Colman, Prentis and Varley, and was deputy chairman at the time of his death.

He had been a Fellow of this Society since 1933 and twice took the Chair at its meetings: in March, 1934, when William Gaunt read a paper suggesting 'How to Improve the Design of British Goods', and in November, 1938, when the subject was 'Advertising Art', and the speaker, McKnight Kauffer. On the former occasion Beddington declared his belief (reaffirmed in his book, *Young Artists of Promise*) in the artist as being both practical and a man of common sense, and epitaphed himself in the observation that gaiety is perfectly compatible with success.

MR. F. W. DEAN

Mr. Francis William Dean, C.B.E., J.P., D.L., who died on 14th April at the age of 74, was a Past President of the Incorporated Association of Architects and Surveyors and had for many years played an active part in the local government of London. An Alderman of St. Marylebone since 1925, he was Mayor of the Borough

in 1924–5 and again in 1951–2. He was a member of the London County Council from 1934 until 1946, in which year he served as Deputy Chairman.

Mr. Dean, who had also been a Justice of the Peace for the County of London since 1936, and a Deputy Lieutenant since 1946, was made C.B.E. in 1954. He became a Fellow of the Society in 1934.

SIR ALFRED SHENNAN

Sir Alfred Shennan, F.R.I.B.A., who died on 6th May, aged 71, was a greatly respected figure in Liverpool, where he had a flourishing architectural practice and had served the city as councillor, magistrate, alderman and chairman of several major administrative committees. An energetic, purposeful and forthright man, he will be remembered in particular for his work as Chairman of the Mersey Tunnel Joint Committee, and for his part in assuring the survival of the Liverpool Philharmonic Society and its orchestra.

Sir Alfred, who was knighted in 1952, became a Fellow of this Society in 1954.

MR. MYRON C. TAYLOR

Mr. Myron Charles Taylor, LL.B., the distinguished American lawyer, industrialist and diplomatist, died in New York on 6th May, aged 85.

A graduate of Cornell University, Taylor early began to apply his knowledge of the law to business organization, and acquired wide experience in the development of railways, banks, textile mills, and the motor-car industry. His success in these spheres impressed J. Pierpoint Morgan, who persuaded him to join the United States Steel Corporation as Chairman of the Finance Committee. Taylor proved himself more than equal to this great responsibility. He greatly reduced the Corporation's debt and steered it through the depression. As Chairman of the Board in succession to Morgan after 1932, he also did much to improve relations between United States Steel and its huge labour force.

A new career awaited Taylor on resigning this office of the Corporation's chief executive in 1938. Relief work led to diplomacy. At the request of President Roosevelt, he took charge of an American delegation to Evian conference on refugee problems, subsequently becoming President of that Conference. In the following year he became Roosevelt's personal representative to Pope Pius XII. This appointment was much resented by Protestant opinion in the United States, and it needed a man of Taylor's calibre to justify such a departure from normal practice. The measure of his achievement is his successful tenure of the post, through all the strains of war, until 1950. President Truman, on succeeding Roosevelt, had asked Taylor to remain as his own representative at the Vatican, and in 1948 presented him with the American Medal of Merit. Taylor finally retired from government service in 1953.

Mr. Taylor was elected a Fellow of the Society in 1940.

NOTES ON BOOKS

THE INDIVIDUAL AND THE UNIVERSE. *B.B.C. Reith Lectures, 1958. By A. C. B. Lovell. London, O.U.P., 1959. 10s 6d net*

The Reith lectures on the B.B.C. were given towards the end of 1958 by Professor A. C. B. Lovell, the Radio Astronomer of Manchester University, who is director of the formidable radio telescope at Jodrell Bank. This monograph consists essentially of the six lectures as broadcast, with slight additions originally cut out because of timing. The six titles make six somewhat independent chapters. I 'Astronomy Breaks Free', II 'Origin of Solar System', III 'The New Astronomy', IV 'Astronomy and the State', V and VI 'The Origin of the Universe'. Since a sound broadcast was involved there are naturally no visual illustrations used in the Reith Lectures. Ironically

enough, the only striking illustrations used in the actual lectures, namely a sound echo reflection from the moon and recorded satellite messages, naturally disappear in print. The book might have been enhanced with a few judicious plates of astronomical objects, but doubtless the price would have gone up.

Professor Lovell gives us a fascinating account of the ultimate impact of radio astronomy on cosmological theories. His first lecture is historical and surveys the Renaissance rebirth of astronomy. Next, the still unsolved problem of the origin of the solar system is surveyed and the various theories neatly compared and contrasted. Chapter III tells of the emergence of radio astronomy, and one feels the excitement which drives on Professor Lovell in his own important tasks with his unique steerable Jodrell Bank radio telescope. Chapter IV is curious. Entitled 'Astronomy and the State', it throws illuminating light on the part played in the past and in the present by national pride in affecting astronomical achievement. It can be remarked here that it has been said in the past that the amount of money spent by a State on pure optical astronomy (which can certainly have little, if any, economic or military value) is a fair measure of the emphasis that State places on purely cultural values. Certainly astronomy to-day is a very costly business indeed. In any event Professor Lovell advocates close partnership between astronomer and State and draws attention to the close link between rocket research and the future of astronomy. It is a sad thought that cosmogony, the purest of the pure in intellectual exercises, is now closely linked with research on destructive projectiles. The last two chapters on 'The Origin of the Universe' lead us to the contemporary fierce controversies about creation, the Primeval Atom Theory of Lemâitre and the Continuous Creation Theory.

This section is a brilliant piece of synthesis and alone justifies the whole book. The formidably difficult interaction between cosmology and theology is sympathetically and cleverly treated. Although there is perhaps inevitably a slightly dogmatic opinion here and there, nevertheless the author is a very judicial arbiter and is quite free from prejudice. His enthusiasm for his own field of radio astronomy leads him to expect that the radio telescope heralds a new epoch in cosmological thought. One thing is clear from this admirable monograph: the bigger the equipment and the more we learn, the more we recognize how small a part man on earth really is in the vast cosmos. Small, it is true, yet can one say insignificant? The future will show whether man, the individual, can break free from the limitations of the earth and yet stretch out into the Universe. Indeed, as this book does really show, the relation between the Individual and the Universe is dimly beginning to take on a new shape.

S. TOLANSKY

ACOUSTICS, NOISE AND BUILDINGS. *By P. H. Parkin and H. R. Humphreys. London, Faber,* 1958. 70*s net*

One of the factors which will contribute to the reduction of noise and the evils it causes is that people who have only a general scientific knowledge should learn something of the general nature and causes of noise. *Acoustics, Noise and Buildings* is particularly valuable for this purpose. It is so well written and arranged that it also gives in logically developed sequence the much more advanced knowledge which will allow defects to be avoided or remedied by architects and builders.

The authors are intimately connected with the investigation of these matters at the Building Research Station and elsewhere. They also have much experience of applying these principles not only to the design of modern buildings and the improvements of existing ones, but to such acoustical masterpieces as the Royal Festival Hall. The special and varied requirements for music are discussed, and there is an appropriate foreword by Mr. Hope Bagenal on this aspect. The complex and difficult problems of reinforcing music and speech are stated so simply that the

elementary principles seem easy. The treatment is also sufficiently thorough to interest and help those having much greater scientific knowledge.

Perhaps the chapters of widest interest are those which deal with noise in buildings. Modern types of construction are likely to be acoustically very bad unless proper consideration is given to this aspect in the design stage. The loss by unnecessary fatigue or by uncertain hearing in rooms used for teaching or discussion, or even as board rooms, must be very great. It can be greatly reduced if existing knowledge is applied at the design stage or later, but it will be at much greater expense, if a serious defect has then to be reduced. Much will be gained, however, if users, after reading the easier parts of this book, realize how much can be done by those architects who will apply the knowledge which is now available.

Chapter 10, 'Criteria for Noise Control and Sound Insulation', gives a most interesting account of the character and magnitude of noise which will cause damage to hearing, or the much lower level which interferes with speech and causes fatigue or confusion. The noise levels which are reasonably acceptable under various conditions have been carefully determined and there are some useful remarks about public reaction to them. The whole chapter is useful as a reasonable and authoritative guide to what is acceptable and what can be done to achieve these levels.

The authors, rightly I think, do not tackle the causation of aircraft noise. It is a complex problem with which only specialists with good facilities can deal. Wisely, also, they do not attempt to examine the most subtle and psychological problem of the small noises which can be desperately annoying. Although many sufferers from these small noises would probably find Chapter 10 rather difficult to read, their scientific friends will be able to gain, and pass on to them in easy form, much which may help them not to worry quite so much.

There is a short section on the various forms of deafness and their causes. It is lucidly expressed and will be interesting to those whose hearing is gradually decreasing with age.

The diagrams are clear and placed adjacent to the text which they illustrate. There are plates illustrating the Royal Festival Hall and other special acoustical achievements. A great deal of data useful for reference is included in Appendices.

Taken as a whole the book is a great contribution to the reduction of noise and the suffering and loss of efficiency it causes. It comes from really authoritative sources, and is really interesting to read.

T. R. CAVE-BROWNE-CAVE

BUILDINGS IN THE COUNTRY. *By Paul Mauger. London, Batsford,* 1959. 70*s net*

This book illustrates a whole range of buildings used by man from the cradle to the grave. It is descriptive rather than discursive. It has little criticism to offer of many buildings badly designed and badly located in the countryside, but it is understood that Mr. Paul Mauger has wished to 'give a guide to the particular requirements of country buildings from the point of view of fitness for the purpose'.

The photographs and plans are very good and will be of the greatest use to all concerned in siting, laying out and designing the many types of buildings illustrated. If there are any omissions, Chapter 3 might have dealt with the whole range of agricultural buildings, including grain-drying plants, boiler houses, Dutch Barns and piggeries, which are so much in the news to-day and for which planning permission is at present generally not required; in total, they are having a considerable effect on the landscape.

The skilful enlargement of villages referred to in Chapter 7 might have included the very real problem in villages which lie in a vulnerable situation for speculative urban development. Mr. Mauger's views on how to govern the rate of building and to secure layout and design with a view to retaining the village character against the

pressure for the erection by private enterprise of urban type dwellings in an urban layout, would have been valuable.

Chapters 10 and 11, dealing with Village Halls and other small buildings required in a village, are very informative. Most of the buildings described and illustrated are designed by competent architects, but unfortunately much of the building (possibly as high as 50 per cent) in small towns and villages has not the benefit of the services of the architectural profession, and reliance on planning control by the local planning authority and by the Minister on appeal has, of course, not wholly secured good design by private enterprise building.

Although the normal domestic buildings in town and village in the total add up to a considerable quantity of buildings in the landscape, Mr. Mauger rightly emphasizes the dramatic impact of new twentieth-century buildings on the countryside. Nuclear power stations, coal- and oil-burning power stations, research laboratories, very large factories and offices are well described in Chapters 1 and 2. As buildings and structures reach skywards, the overshadowing effect on existing development is of paramount importance and is well illustrated by the plan on page 39, which indicates the overshadowing of the village in the early afternoons by the great cooling towers which dominate the surroundings. This overshadowing effect of tall buildings in towns is a probelm that always receives full consideration against the background of the daylighting code, etc. Mr. Mauger has rightly indicated that it often requires equally serious consideration in the countryside. Power stations require transmission lines and their impact on the landscape is great and often controversial; equally great in that impact, however, are the new structures being erected by the Central Electricity Generating Board and the Area Boards, viz., the very large switchgear and substation installations which often cover many acres of ground and reach to a height of 40 ft. or more. They are sometimes located in strategic points in the countryside to receive major transmission lines from many directions, sometimes adjacent to the station. This problem was referred to in Miss Sylvia Crowe's *The Landscape of Power*, which may well be read together with Mr. Mauger's Chapter 1.

Mr. Mauger's book serves as a good reminder that all is not Subtopia and that, given the professional skills available, buildings of almost any size and function can be successfully located in a town, village or in the open country.

L. N. FRASER

GEORGIAN CHRONICLE; MRS. BARBAULD AND HER FAMILY. *By Betsy Rodgers. London, Methuen, 21s net*

The central characters of this delightful family history are John Aikin (1747–1822) and his sister Anna Laetitia (1743–1825), remembered by her married name as Mrs. Barbauld. Their father was a tutor at the Dissenting Academy in Warrington and they were brought up in a remarkable atmosphere of scientific inquiry, educational experiment and practical religion. The fanaticism of the Nonconformists which had marked their conflicts with Church and Crown in the seventeenth century had lessened by the middle of the eighteenth and they had, in the words of John's daughter Lucy, 'begun to break forth out of the chains and darkness of Calvinism and their manners softened with their system'. Both John and Anna acquired at Warrington a taste and a capacity for social enjoyments which served them well when her poetry and his medical attainments made them acceptable to an ever-widening circle of celebrities.

In the earlier part of their careers their Dissenting background proved no handicap for brother and sister. Both Anna's boarding school in Suffolk and John's medical practice at Great Yarmouth were supported by Churchmen. In London they were received indifferently by supporters of the Government and the Opposition: 'We were often amused with the different sentiments of the several parties in which

we passed the day. At Mr. Brand Hollis's the nation was ruined; notwithstanding which we ate our turkey and drank our wine as if nothing had happened. In the evening party there was nobody to be pitied but the poor king and we criticized none but Mrs. Siddons.' In Norwich, Mrs. Barbauld was 'so much engaged with dinners and suppers' that she said she had no time to write to her brother, although what she did write has enabled Mrs. Rodgers to paint a picture of a way of life which makes the twentieth century seem bleak indeed. Tragedy, however, lay in wait. The insanity of Rochemont Barbauld and John's decline in health were personal troubles which coincided with an international upheaval which caused brother and sister to take an unpopular stand. Their support for the French Revolution aroused the dormant suspicions of their loyalist acquaintances. Had not Priestley taught at Warrington and Marat declared his love for Mrs. Barbauld? The storm passed. In 1802 John Aikin, who had retired to the then unspoiled village of Stoke Newington, wrote that he was 'cured of all theoretical ideas of reform', and in the same year his sister came to settle permanently nearby. She lived on to cross swords with the great Romantics and to receive the homage of her talented niece and nephew, Lucy Aikin (1781–1864), the popular historian, and Arthur Aikin (1773–1854), Unitarian minister, chemist, geologist and secretary of this Society for twenty-three years.

Mrs. Rodgers confirms the engaging character sketch of Arthur Aikin which can be found in Trueman Wood's History. She prints ten of his unpublished letters and quotes from the memoirs of his niece, whom he permitted to roam about the Society's House 'whenever there were no meetings of members', and whose childhood mind was vividly impressed by Barry's paintings. A point not mentioned is that Arthur Aikin had been a subscribing member of the Society from 1802 to 1806, which was eleven years before he entered its service. He was elected a life member on his retirement in 1839.

It is a pity that reference to the scholarly notes is made difficult by their being placed together at the end of the book under chapter numbers, while in the text itself the chapters are identified only by titles.

D. G. C. A.

SOME OUTSTANDING CLOCKS OVER SEVEN HUNDRED YEARS, 1250–1950. *By H. Alan Lloyd. London, Leonard Hill,* 1958. 70*s net*

Clocks and how they work has always been, to the scientifically curious, one of the most fascinating subjects, and this important book by Mr. Alan Lloyd will certainly enhance the fascination. It is perhaps fortunate that it should have been published at about the same time as the acquisition by the British Museum of the famous Ilbert collection of clocks and chronometers, which is probably the finest collection of its kind in the world; the public was given a preview of a part of it in the exhibition 'Pendulum to Atom', at the Goldsmiths' Hall during October and November, 1958.

Mr. Alan Lloyd is concerned less with the typical than with the exceptional in clock-making, and his book is therefore supplementary to Britten's *Old Clocks and Watches and Their Makers*, which in the latest edition excludes clocks that might be classified as exceptional or unique. Mr. Lloyd's book, on the other hand, 'presents, almost exclusively, complicated and unique examples'. With a few inevitable exceptions, clocks illustrated in Britten will not be found in Mr. Lloyd's book, and *vice versa*. The two works are thus complementary.

What makes Mr. Lloyd's book of particular value is that a good deal of new material is presented, while a new light has been cast on the origin of some of the important inventions in the mechanism of clocks. For example, Leonardo da Vinci has sometimes been regarded as the inventor of the fusee and of the coiled spring as a motive force largely because of sketches in his notebooks; but Mr. Lloyd adduces evidence to show that both the coiled spring and fusee were earlier than Leonardo's notes.

He points out that in addition to his own inventions, Leonardo probably made sketches of the inventions of others that interested him.

Perhaps the most remarkable clock described by Mr. Lloyd is that made by Giovanni de Dondi, one of the earliest and now, unfortunately, lost. The account that he is able to give is by Dondi himself, who left an extremely full description of the mechanism. Mr. Lloyd mentions that, although the Latin manuscripts have received a good deal of attention in the past 150 years, it has not been from the standpoint of the real reason for their existence—horology. In at last devoting this attention to them the author remarks that he 'is now able to give to the world full details of this outstanding masterpiece, which has lain buried in its Latin shroud for six hundred years'. Accompanying the description, a considerable number of sketches are reproduced, and the reader, fortified by some acquaintance with the history of astronomy, can enjoy the entertainment offered by this remarkable fourteenth-century mechanism, which was taken by the Emperor Charles V to the Convent of San Yste in Spain, where it remained until the Peninsular War. It disappeared when the Convent was fired by the French.

Mr. Lloyd continues his narrative in stages of a century each, describing many of the remarkable, ingenious and sometimes beautiful clocks in various countries and often giving fresh and unfamiliar information about each. For example, the 'miniature' copy of the second Strasburg clock by Isaac Habrecht in the British Museum is one of the best known of sixteenth-century clocks which has been described many times. But recently it has been thoroughly overhauled by Mr. S. A. Gildersleve of the Science Museum, and the parts photographed (they are reproduced here for the first time), while the author has been able to avail himself of the notes made on the occasion.

The last example that Mr. Lloyd describes is the ingenious York Minster Memorial Clock, designed by Dr. Atkinson and unveiled in 1955, which makes a worthy conclusion to a valuable record that is not likely to be superseded for many years to come. The book is a handsome production with a large number of fine photographs supplemented by numerous explanatory diagrams. It is a pleasure to pay tribute to such a work.

ARNOLD WHITTICK

PUPPETS AND PUPPETRY. *By Cyril Beaumont. London, The Studio,* 1958. 35*s net*

One of the most fascinating and informative books on puppetry ever to be published in the English language was Cyril Beaumont's *Puppets and the Puppet Stage*, and, together with the translation of Max von Boehn's *Dolls and Puppets*, it was the most sought-after book on the subject before and during the Second World War. At the beginning of the war it went out of print, and its demise engendered a keen sense of loss amongst all those who stood on, or near, the brink of this renaissance of the art of puppetry which is now so very evident.

In 1947 it was rumoured that the book was to be republished, and we, the puppeteers of this country, eagerly sent in our photographs in the hope of being included in the new edition. But as the years passed and no new edition appeared we lost faith . . . and now, suddenly the new publication is upon us, and with affection and delight we thumb through its pages.

Here, for the uninitiated, is a feast of fantasy, and for the established puppeteer a welter of reference. Pictures of puppets from many lands are shown. Amongst the most interesting are those from Germany and France, with reproductions showing the creative work of Harro Siegel to be of a very high aesthetic order, and that of André Tahon and Gera Blattner, most imaginative.

The examples shown in the British section go to prove that no one has yet improved upon the work of the old 'pioneer' and sculptor William Simmonds. His 'Snowball and Estrella' and 'Mahogany Suite' are shown in a couple of first-rate illustrations.

The sections on the Greeks, Japanese and Russians are packed with interest and there is a new chapter on film-making with puppets, with a special accent on the work being done in Czechoslovakia and Poland.

It is a bigger book than it used to be, with 400 illustrations and a great deal more text; the publishers, in fact, insist that it is not the same book at all. But to us it is Cyril Beaumont's Puppet Book, as it always was, and we welcome it back in its new guise most warmly.

I have only two small points to criticize adversely: (1) the inclusion of shop-window display figures which, though most beautiful in design, are surely, being inanimate, dolls or display figures and not puppets; and (2) the few examples shown of creatures which were made by amateurs and have never been put to their proper use. However exquisite these characters may be, unless they have appeared on a stage before a public, or in a film, they cannot be considered puppets in the true sense, any more than a beautiful but otherwise deficient student from R.A.D.A. could be called an actress.

But these minor quibbles should not put the reader off. Here is a book which anyone with a sense of aesthetic appreciation will pore over and absorb for hours on end. I know this because I have seen such people do it.

JOHN WRIGHT

SHORT NOTES ON BOOKS

THE HISTORY AND TECHNIQUE OF LETTERING. *By Alexander Nesbitt. New York, Dover Publications,* 1957. (*London, Constable,* 16*s net*)

Written from the point of view of the artist or typographer, this book has two parts, both fully illustrated with good examples. The first is a survey of the development of lettering forms, from the earliest pictographs and hieroglyphics to the work of Larisch, Koch, Gill and other modern artists. The second provides a practical course in lettering. There are a bibliography and a good index. Though paper-bound, the volume is durable.

THE ANDREWS DIPTYCH. *By John Beckwith. London, H.M.S.O. (for the Victoria and Albert Museum),* 1958. 8*s*

The Andrews Diptych in the Victoria and Albert Museum is a unique ivory carving illustrating the miracles of Christ. In this comparative study Mr. Beckwith concludes, on mainly stylistic grounds, that it was made in Italy between 450 and 460. The numerous plates are admirably reproduced.

DRESS AND UNDRESS. *The Restoration and the Eighteenth Century. By Iris Brooke. London, Methuen,* 1958. 30*s net*

This work deals with both formal and informal dress, and includes many descriptions from contemporary sources. Most of the author's illustrations are taken from existing garments preserved in private collections or museums.

THE STATE AND THE ARTS. *By the Rt. Honble. Lord Bridges. Oxford, Clarendon Press,* 1958. 2*s* 6*d net*

The Romanes Lecture, 1958, in which Lord Bridges examines the present system of State patronage and considers ways in which it might be revised. He concludes that there is room for the development of a fuller partnership in artistic matters between central and local bodies.

FROM THE JOURNAL OF 1859

VOLUME VII. *17th June*

OPENING OF ART GALLERIES IN THE EVENING

The following letter has been addressed to the Trustees of the National Gallery, by the Earl of Shaftesbury, as President of the Young Men's Christian Association:

Young Men's Christian Association, 165, Aldersgate-street,
London, E.C., 26th May, 1859.

SIR,—With reference to the letter addressed by the Council of the Society of Arts to the Trustees of the National Gallery, urging upon them the importance of allowing the several collections of Paintings, which are National property, to be opened to the public during suitable hours in the evening, for the convenience and instruction of the large class of persons whose avocations render it impossible for them to take advantage of the opening of the public Galleries and Museums during the day, I beg, as President of the Young Men's Christian Association, very earnestly to support this appeal for an act of consideration to the multitude of clerks, shopmen, traders, artizans, and others engaged in the active business of life, which will be deeply and gratefully appreciated by them, and which will, apart from its educational value and importance, tend to produce the most valuable moral results.

The experience acquired in the various labours of this Association justifies the assertion, that a large proportion of the follies and vices of young men arise not so much from a mere propensity to indolence and irregularity of conduct, as from the very general privation of social and domestic comforts, and the absence of opportunities for safe and suitable recreations and enjoyments.

To secure to them, therefore, the advantage of free access, in their leisure hours, to our National Museums and Galleries, will be to provide a most salutary check to the influence of evil habits and, in improving the moral tone and character of this large class of the community, to elevate the manners and increase the comforts of society at large.

Its bearing upon those aspects of sanitary reform which are associated with the character and condition of the dwellings of the people, is scarcely less important; and upon all these grounds I most earnestly commend the desired alteration to the most favourable consideration of the Trustees of the National Gallery.

I am, Sir,
Your obedient servant,
(Signed) SHAFTESBURY

The Secretary to the
Trustees of the National Gallery.

[*The Council of the Society wrote again to the Trustees of the National Gallery on 30th May, urging that the whole collection of pictures there should be open in the evening, but without success. At the instigation of the Council the matter was then debated in both Houses of Parliament, and in December, 1859, it was announced that paintings of the British School housed in a wing of the South Kensington Museum would henceforward be accessible to the public on those evenings when the Museum itself was open. But the National Gallery in Trafalgar Square was not affected by this concession.*]

LIBRARY ADDITIONS

Fellows and Associates are reminded that they may borrow up to five books at a time from the Library and retain them for a month. Members living outside London may borrow books by post. Books sent by post are despatched at the cost of the Society and returned at the cost of the borrower. Books marked with an asterisk are part of the reference library, and not normally available for loan.

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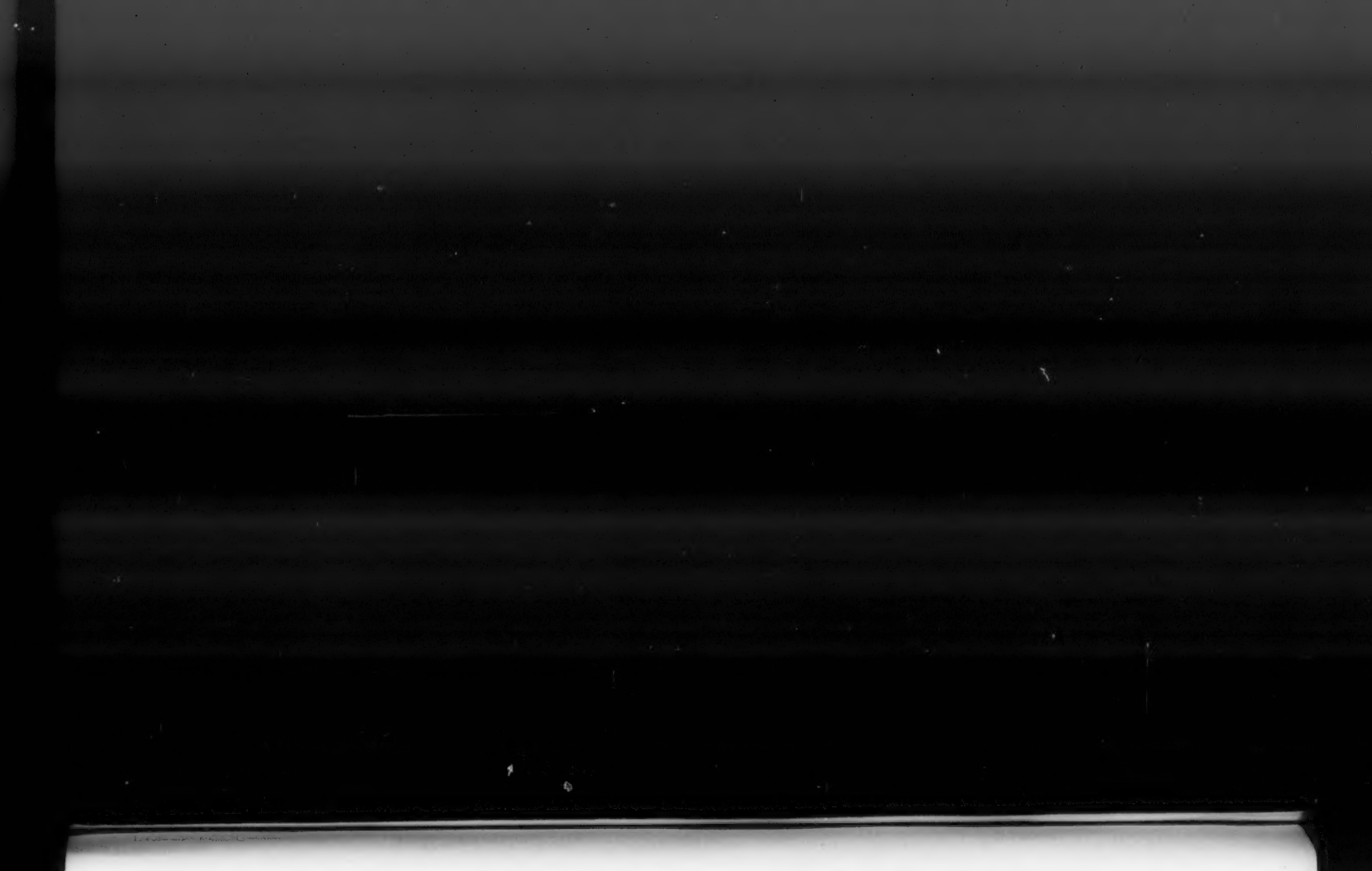
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